

Examinations leading to the Degree of Bachelor of Science
Three Years(Six Semesters) Degree Programme under Choice Based Credit System(CBCS)

ANNEXURE-A-1

Scheme of Teaching, Learning, Examination and Evaluation(B.Sc. Semester I-
Mathematics)(Semester-I)

Sr.No	Subject	Subject Code	Teaching & Learning Scheme							Duration of Exams	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits				Hrs.	Maximum Marks					Minimum Passing
			L	T	P	Total	Theory/ Tutorial	Practical	Total	Theory + M.C.Q Ext.		Skill Enhancement Module (SEM)Int.	Practical		Total Marks	Marks	Grade
									Internal	External							
1	Compulsory English		4	-		4	3	-	3	2	40	10	-	-	50	20	P
2	Communication Skill in English(AEC)		-	1	-	1	0.75	-	0.75	1			25	-	25	10	P
3	Second Language		2	-	-	2	1.5	-	1.5	2	40	10	-	-	50	20	P
4	Communication Skill in Second Language(AEC)		1	-	-	1	0.75	-	0.75	1			25	-	25	10	P
5	Mathematics,(DSC-1) Paper-I		4	1	-	5	3.75	-	3.75	3	60	15	-	-	75	30	P
6.	Mathematics(DSC-2) Paper-II		5	-	-	5	3.75	-	3.75	3	60	15	-	-	75	30	P
7.	Science Subject 1 excluding Mathematics(DSC-3)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
8.	Practical for Science Subject1 (DSC-3) excluding Mathematics(DSC-4)		-	-	6	6		2.25	2.25	3	-	-	25	25	50	25	P
9	Science Subject 2 excluding Mathematics(DSC-5)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
10	Practical for Science Subject 1 (DSC-5) excluding Mathematics(DSC-6)		-	-	6	6		2.25	2.25	3	-	-	25	25	50	25	P
11	Generic Elective I (GOEC)		2	-	-	2	2	-	2	2	College Level examination				50	20	p
12	Induction Programme*		30 hrs(at thebeginningof1 st Semester) 1													10	P
	Total					44			30						650		

L:Lecture,T:Tutorial,P:Practical

Note :1.Internship /Field Work / Work Experience will be conducted after I semester till V semester in vacations for minimum 120 hours. It's credits and grades will be reflected in final semester VI credit grade report.- OEC (Optional) can be studied during semester I to VI, Its credits and grades will be reflected in final semester VI credit grade report

2. Teaching period in the various subjects in the faculty of science shall be as prescribed by the executive council dated 1/2-4-1977,11-7-1977Appendix-F

3. If DSC (excluding Mathematics)is Physics, then 1 Tutorial be added.

Examinations leading to the Degree of Bachelor of Science
Three Years(Six Semesters) Degree Programme under Choice Based Credit System(CBCS)
 Scheme of Teaching, Learning, Examination and Evaluation(B.Sc.SemesterII-Mathematics)(Semester-II)

Sr.No	Subject	Subject Code	Teaching & Learning Scheme							Duration o Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits				Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory/Tu torial	Practical	Total		Theory + M.C.Q Ext.	Skill Enhancement Module (SEM) Int.	Practical		Total Marks	Marks	Grade
												Internal	External				
1	Compulsory English		4	-		4	3	-	3	2	40	10	-	-	50	20	P
2	Communication Skill in English(AEC)		-	1	-	1	0.75	-	0.75	1			25	-	25	10	P
3	Second Language		2	-	-	2	1.5	-	1.5	2	40	10	-	-	50	20	P
4	Communication Skill in Second Language(AEC)		1	-	-	1	0.75	-	0.75	1			25	-	25	10	P
5	Mathematics,(DSC-7) Paper-III		4	1	-	5	3.75	-	3.75	3	60	15	-	-	75	30	P
6.	Mathematics(DSC-8) Paper-IV		5	-	-	5	3.75	-	3.75	3	60	15	-	-	75	30	P
7.	Science Subject 1 excluding Mathematics(DSC-9)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
8.	Practical for Science Subject1 (DSC-9) excluding Mathematics(DSC-10)		-	-	6	6		2.25	2.25	3	-	-	25	25	50	25	P
9	Science Subject 2 excluding Mathematics(DSC-11)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
10	Practical for Science Subject 1 (DSC-11) excluding Mathematics(DSC-12)		-	-	6	6		2.25	2.25	3	-	-	25	25	50	25	P
11	Generic Elective II (GOEC)		2	-	-	2	2	-	2	2	College Level examination				50	20	p
	Total					44			29						650		

L:Lecture,T:Tutorial,P:Practical

Note:1.Internship/Field Work/Work Experience will be conducted after I semester till V semester in vacations for minimum 120 hours .It's credits and grades will be reflected in final semester VI credit grade report.-OEC(Optional)can be studied during semester I to VI ,Its credits and grades will be reflected in final semester VI credit grade report

2. Teaching period in the various subjects in the faculty of science shall be as prescribed by the executive council dated 1/2-4-1977,11-7-1977, Appendix-F

3. If DSC (excluding Mathematics) is Physics, then 1 Tutorial be added.

Examinations leading to the Degree of Bachelor of Science
Three Years (Six Semesters) Degree Programme under Choice Based Credit System (CBCS)
Scheme of Teaching, Learning, Examination and Evaluation (B.Sc. Semester I -Excluding Mathematics) (Semester-I)

ANNEXURE – A3

Sr. No	Subject	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits				Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory/ Tutorial	Practical	Total	Theory + M.C.Q Ext.	Skill Enhancement Module (SEM) Int.	Practical		Total Marks	Marks	Grade	
							Internal	External									
1	Compulsory English		4	-		4	3	-	3	2	40	10	-	-	50	20	P
2	Communication Skill in English (AEC)		-	1	-	1	0.75	-	0.75	1			25	-	25	10	P
3	Second Language		2	-	-	2	1.5	-	1.5	2	40	10	-	-	50	20	P
4	Communication Skill in Second Language (AEC)		1	-	-	1	0.75	-	0.75	1			25	-	25	10	P
5	(DSC-1)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
6.	Practical for (DSC-1), DSC-2		-	-	6	6	-	2.25	2.25	3	-	-	25	25	50	25	P
7.	(DSC-3)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
8	Practical for (DSC-3), (DSC-4)		-	-	6	6	-	2.25	2.25	3	-	-	25	25	50	25	P
9	(DSC-5)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
10	Practical for (DSC-5)- (DSC-6)		-	-	6	6	-	2.25	2.25	3	-	-	25	25	50	25	P
11	Generic Elective I (GOEC)		2	-	-	2	2	-	2	2	College Level examination				50	20	p
12	Induction Programme*					30 hours(at the beginning of 1 st Semester)				1						10	P
	Total					46			29.25 (rounded off to 29)						650		

L: Lecture, T: Tutorial, P: Practical

Note : 1. Internship /Field Work / Work Experience will be conducted after I semester till V Semester in vacations for minimum 120 hours. It's credits and grades will be reflected in final Semester VI credit grade report. - OEC (Optional) can be studied during semester I to VI, Its credits and grades will be reflected in final semester VI credit grade report

2. Teaching period in the various subjects in the faculty of science shall be as prescribed by the executive council dated 1/2-4-1977, 11-7-1977 Appendix- F

3. If DSC (excluding Mathematics) is Physics, then 1 Tutorial be added.

Examinations leading to the Degree of Bachelor of Science
Three Years (Six Semesters) Degree Programme under Choice Based Credit System (CBCS)
Scheme of Teaching, Learning, Examination and Evaluation (B.Sc. Semester II -Excluding Mathematics) (Semester-II)

ANNEXURE – A4

Sr. No	Subject	Subject Code	Teaching & Learning Scheme							Duration of Exams	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits			Hrs.	Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory/ Tutorial	Practical	Total		Theory + M.C.Q Ext.	Skill Enhancement Module (SEM) Int.	Practical		Total Marks	Marks	Grade
													Internal	External			
1	Compulsory English		4	-		4	3	-	3	2	40	10	-	-	50	20	P
2	Communication Skill in English (AEC)		-	1	-	1	0.75	-	0.75	1			25	-	25	10	P
3	Second Language		2	-	-	2	1.5	-	1.5	2	40	10	-	-	50	20	P
4	Communication Skill in Second Language (AEC)		1	-	-	1	0.75	-	0.75	1			25	-	25	10	P
5	(DSC-7)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
6.	Practical for (DSC-7), DSC-8		-	-	6	6	-	2.25	2.25	3	-	-	25	25	50	25	P
7.	(DSC-9)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
8 .	Practical for (DSC-9), (DSC-10)		-	-	6	6	-	2.25	2.25	3	-	-	25	25	50	25	P
9	(DSC-11)		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
10	Practical for (DSC-11)- (DSC-12)		-	-	6	6	-	2.25	2.25	3	-	-	25	25	50	25	P
11	Generic Elective II (GOEC)		2	-	-	2	2	-	2	2	College Level examination				50	20	p
	Total					46			28.25 (rounded off to 28)						650		

L: Lecture, T: Tutorial, P: Practical

Note : 1. 1. Internship /Field Work / Work Experience will be conducted after I Semester till V semester in vacations for minimum 120 hours. It's credits and grades will be reflected in final Semester VI credit grade report. – OEC (Optional) can be studied during semester I to VI, Its credits and grades will be reflected in final Semester VI credit grade report

2. Teaching period in the various subjects in the faculty of science shall be as prescribed by the executive council dated 1/2-4-1977, 11-7-1977 Appendix- F

3. If DSC (excluding Mathematics) is Physics, then 1 Tutorial be added.

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B. Sc. Botany

POs:

The students graduating with the degree B.Sc. with Botany will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

Upon completion of the programme successfully, students would be able to

1. Identify major groups of plants and compare the characteristics of lower (microbes, algae ,fungi, bryophytes and pteridophytes) and higher (Gymnosperms and angiosperms).
2. use evidence based comparative botany approach to explain the evolution of organism and understand the genetic diversity.
3. explain various plant processes and functions, metabolism, concepts of gene, genome and how organism's function is influenced at the cell, tissue and organ level.
4. understand adaptation, development and behavior of different forms of life.
5. demonstrate the experimental techniques and methods of their area of specialization in Botany.

Employability Potential of the Programme:

A career in botany can be one of the most preferred careers for the science graduate. The subject botany, which is related to the study of plants means studying about algae, fungi, diseases, higher plants, growth, metabolism and the structure among different groups. Job profile in botany includes study of plants, research, working with various industries, teaching, self-employment and many more fields.

Botany person is able to study plant life along with finding solutions to problems related to that of forest and agriculture. Botanist also deals with space travel agriculture, artificial environments, hydroponics and various other interesting areas of research.

Botany graduates and post graduates are required by various organizations ranging from local to multinationals to research organizations to hospitality and tourism industry depending upon their nature of activities. They fit into different roles depending upon nature of work and evolve into senior position at high salaries.

After graduation in botany, candidate can look forward to being a part of industry such as pesticide, fungicide, biofertilizer, food processing unit, pharmaceuticals etc. by working as a lab technician.

The amount of diversity in the field of botany gives liberty to student to choose specialization as per their own interest, choice and interest. Student can work in organization/ industry as a

- I. Plant explorer with special skill of writing, photography, passion in expedition etc.
- II. Conversationalist in organizations working for conservation of environment
- III. Ecologist
- IV. Environment consultant
- V. Agriculture consultant
- VI. Botanical Field technician
- VII. Green house operator
- VIII. Plant biochemist
- IX. Horticulturist
- X. Nursery manager
- XI. Taxonomist
- XII. Plant pathologist
- XIII. Farming consultant
- XIV. Molecular biologist

The numbers of professions for botanist are endless. More ever the applications of plant sciences improve the yield and supply of medicine, food fibers, building materials and other plant products. The knowledge

of plant sciences is essential for development and management of forests, parks, waste land, sea wealth etc. Few examples of industry with which botany student can work are

- Chemical industry
- Food industry
- Arboretum
- Forest services
- Botanical survey of India
- Biotechnology firms
- Oil industry
- Land management agencies
- Seed and Nursery companies
- Plant health inspection services
- National parks
- Biological supply houses
- Plant resources laboratory
- Educational institutions

The pay scale of botanist has views diversity ranging from 15000 to 60000 and more per month depending upon job role and organization. Salary also varies in government and private sector. One can secure job through competitive exams in government sector such as forest services, biological survey of India, in teaching field, research assistant etc.

Future Prospectus

A student offering botany as a subject for his graduation has tremendous scope for his progression

- ❖ Botany student can opt for further study in number of esteemed institutions of national importance like IIT, IISER, ATREE, NIT, IISc, BARK, TIFR.
- ❖ After graduation student can opt for M Sc in various applied subject like Plant Breeding, Seed technology, genetic engineering, plant biotechnology etc. in addition to M Sc in botany
- ❖ One can establish his own industry
- ❖ Can opt entrepreneur as his career
- ❖ One Can make his career as administrative officer through state and union public service commission IFS, IAS, Range forest officer, drug inspector etc.
- ❖ Huge scope in research with prestigious institution like CCMB, TIFR, IIT, IISc etc.
- ❖ Student can opt teaching in Kendriya vidyalaya, Navodaya vidyalaya etc. by taking degree like B Ed or can crack National eligibility test or state eligibility test and become senior lecturer in higher education.

**Scheme of Teaching, Learning & Examination leading to the Degree in Bachelor of Science in the Programme Environmental Science
(Three years- Six Semester Degree Programme- C.B.C.S.)
(B.Sc. Part I) Semester I**

Sr.	Subject	Subject code	Teaching & Learning Scheme							Duration of Exam Hours	Examination & Evaluation Scheme						
			Teaching Periods Per Week				Credits				Theory		Practical		Total Marks	Minimum Passing	
			L	T	P	Total	T/T	Practical	Total			Theory+ MCQ External	Skill Enhancement Module	Internal	External		Marks
1	DSC I Environment & Ecology	EVS (1S)	6	-	-	6	4.5	-	4.5	03	80	20	-	-	100	40	P
2	Lab	EVS 1S PR	-	-	6	6	-	2.25	2.25	03	-	-	25	25	50	25	P
3	Total		6	-	6	6	4.5	2.25	6.30	06	80	20	25	25	150	65	P

L: Lecture, T: Tutorial, P: Practical

Student may complete their Internship/ Field Work/ Work experience from Second to Fifth semester of Bachelor of Science in the Programme, according to their convenience; @ denotes Non-Examination credits.

Note: Internship/ Apprenticeship/ Field Work Experience (during vacations of semester II to V This will carry 5 credits for learning of 150 hours. Its credits and grades will be reflected in final semester VI credit grade report.

Scheme of Teaching, Learning & Examination leading to the Degree in Bachelor of Science in the Programme Environmental Science
(Three years- Six Semester Degree Programme- C.B.C.S.)
(B.Sc. Part I) Semester II

Sr.	Subject	Subject code	Teaching & Learning Scheme							Duration of Exam Hours	Examination & Evaluation Scheme						
			Teaching Periods Per Week				Credits				Theory		Practical		Total Marks	Minimum Passing	
			L	T	P	Total	T/T	Practical	Total			Theory+ MCQ External	Skill Enhancement Module	Internal	External		Marks
1	DSC -2 Physical Environment & Natural Resources	EVS (2S)	6	-	-	6	4.5	-	4.5	03	80	20	-	-	100	40	P
2	Lab	EVS 2S PR	-	-	6	6	-	2.25	2.25	03	-	-	25	25	50	25	P
3	Total		6	-	6	6	4.5	2.25	6.30	06	80	20	25	25	150	65	P

L: Lecture, T: Tutorial, P: Practical

Student may complete their Internship/ Field Work/ Work experience from Second to Fifth semester of Bachelor of Science in the Programme, according to their convenience; @ denotes Non-Examination credits.

Note: Internship/ Apprenticeship/ Field Work Experience (during vacations of semester II to V This will carry 5 credits for learning of 150 hours. Its credits and grades will be reflected in final semester VI credit grade report.

Syllabus Prescribed for Three Year UG Programme

Programme : B.Sc.

Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
BOT(1S)/Botany	DIVERSITY Of MICROBES , PHYCOLOGY, MYCOLOGYAND PHYTOPATHOLOGY	72

Cos

After completion of this course successfully , the students would be able to

- 1. **understand** microbial diversity, reproduction and economic importance.
- 2. **differentiate** the microbes, algae and fungi on the basis of morphology, cellular organization, nutrition and metabolic activities.
- 3. **classify** and **identify** the various algal genera.
- 4. **classify** and **identify** the various fungal genera.
- 5. **Systematize** the plant diseases and their pathogens
- 6. **Apply** understanding of microbial diversity, phycoology and mycology for teaching primary to high school students

	Unit	Content
UNIT-I	Introduction to Microbial World 1.1 Important groups of Microorganisms- Prion, Viroids ,Viruses, Mycoplasma, Eubacteria, Archaeobacteria and Cyanobacteria 1.2 Viruses – General characteristics and Morphological types of viruses , Structure of TMV and SARS-CoV-2 (Covid-19) , Replication of viruses- lytic & lysogenic , Economic importance of viruses with reference to vaccine production. 1.3 General characteristics and Economic importance of Archaeobacteria, General characteristics, cell structure, reproduction and economic importance of bacteria with reference to industry (Fermentation and Medicines)	12
UNIT-II	Cyanobacteria and Algae 2.1 General characteristics, structure and reproduction of cyanobacteria. 2.2 Introduction to cryptogams. 2.3 General characteristics of algae with reference to habitat, thallus organization, pigmentation, reserve food and reproduction. 2.4 Classification according to F.E. Fritsch up to the classes 2.5 Economic importance of algae as food and in industry. 2.5.1 Ecological importance of Cyanobacteria with reference with soil fertility.	- - - - - - - - - 1 2
Unit-III	Algae General characteristics of following Classes and life cycle of respective genera. 3.1 Chlorophyceae - <i>Oedogonium</i> 3.2 Charophyceae - <i>Chara</i> (only Morphology and Sex organs) 3.3 Xanthophyceae - <i>Vaucharia</i> 3.4 Phaeophyceae - <i>Ectocarpus</i>	12

	3.5 Rhodophyceae - <i>Batrachospermum</i>	
UNIT-IV	Introduction to Fungi 4.1 General Characteristics of Fungi 4.2 Classification of fungi (Ainsworth-1973) 4.3 General characteristics of following Subdivisions and life cycle of respective genera 4.3.1 Myxomycotina - <i>Stemonitis</i> 4.3.2 Mastigomycotina- <i>Albugo</i> 4.3.3 Zygomycotina - <i>Rhizopus</i> 4.3.4 Ascomycotina - <i>Aspergillus</i>	12
UNIT-V	Fungi and Applied Mycology 5.1 General characteristics of following Subdivisions and life cycle of respective genera 5.1.1 Basidiomycotina - <i>Puccinia graminis tritici</i> 5.1.2 Deuteromycotina - <i>Alternaria</i> 5.2 Lichen –Types and Economic importance 5.3 Applied mycology - Application of fungi in industry , medicines and agriculture	12
UNIT-VI	Phytopathology 5.1 General symptoms – Rust, smut , powdery mildew, downy mildew, blight , stem rot and root rot ,anthracnose, leaf spot etc. 5.2 Symptoms, Pathogen biology and disease management of Bacterial diseases- 5.2.1- Citrus canker 5.2.2- Angular leaf spot of cotton 5.3 Symptoms, pathogen biology and disease management of viral diseases- 5.3.1- Yellow vein mosaic of Bhindi 5.3.2-Curl leaf of papaya 5.4 Symptoms, pathogen biology and disease management of fungal diseases 5.4.1. Tikka disease of groundnut 5.4.2 Powdery mildew of <i>Tectona grandis</i> (Teak)	12
	*SEM-- Mycotechnology and Phytopathology 1.Mycorrhizal technology – 1.1 Definition, types and application of Mycorrhiza 1.2 Arbuscular Mycorrhizal Fungi (AMF) - Isolation technique of AMF spores and identification. 1.3 Soil trap culture, Monoculture , Mass multiplication and Biofertilizer. OR 2. Mushroom cultivation technology 2.1 Nutritional and medicinal value of edible mushroom 2.2 Types of edible mushroom available in local area- <i>Agaricus bisporus</i> , <i>Pleurotus</i> . 2.3 Cultivation technology – infrastructure , substrate, polythene bags, vessels, sterilization ,preparation of spawn, bed preparation ,paddy straw (or locally available), etc. 2.4 Storage and marketing. Or 3. Study of plant pathology of local crop plants. 1.1 Symptomology 1.2 Fungal diseases of cotton and soybean 1.3 Chemical fungicides against diseases of cotton and soybean. 1.4 Biological control	
	COs:- After completion of skill enhancement module learner will be able to 1. Acquire skill of isolation of Arbuscular Mycorrhizal Fungal and also able to classify the various species of mycorrhiza. 2. Evaluate the AMF spore in the soil sample of crop plants.	

	3. Establish own production unit of mushroom cultivation 4. Asses the economy of mushroom cultivation 5. Diagnosed the local crop diseases. 6. Advise the proper fungicides or other measures to prevent crop diseases.	
	** Activities- 1. Collection of rhizosphere soils from different locations and isolation of AMF spores from these soil samples and identification Submission of skill enhancement report with microphotographs of AMF species its culture. OR 2. Hands on training to students on mushroom cultivation outside institution 3. Visit to local mushroom cultivation center and submission of its report / Internship in mushroom cultivation center 4. Arranging workshop of mushroom cultivation for hands on training within institution. 5. Submission of activity report. OR 1. Collection of diseased plant parts of soybean and cotton from local fields. 2. Diagnosis of disease on the basis of symptoms and micro-examination or culturing of pathogen. 3. Suggestion of fungicide or biological control. 4. Report submission including photographs and microphotographs of host and pathogen.	

Course Material/Learning Resources

Text books:

1. Dube, H. C. (1990). An Introduction to Fungi. Vikas Pub. House Ltd. New Delhi.
2. Gangulee, H. C. and Kar, A.K. (2001). College Botany Vol. II. Books and Allied Press Ltd. Kolkata.
3. Krushnamurthy, K. V. (2007). An advanced Text Book on Biodiversity: Principles and Practice. Oxford and IBH Publishing Kumar, H.D. (1988). Introductory Phycology. Affiliated East-West Pres Ltd. New Delhi.
4. Kumar, H. D. and Singh, H.N. (1976). A Text Book of Algae. Affiliated East-West Pres Ltd. New Delhi.
5. Mehrotra, R. S. and Aneja, C.R. (1990). An Introduction To Mycology, Wiley Eastern Ltd. New Delhi.
6. Pandey, B.P. (1994). A Text Book of Botany-Algae. S.Chand and Co. Ltd. New Delhi.
7. Pandey, S.N. and Trivedi, P.S. (1997). A Text Book of Botany Vol. II, Vikas Publishing House (P.) Ltd. New Delhi.
8. Pandey, S.N. and Trivedi, P.S. (1997). A Text Book of Botany Vol. I, Vikas Publishing House (P.) Ltd. New Delhi.
9. Pandey, S.N., Trivedi, P.S. and Mishra, S.P. (1995). A Text Book of Algae, Vikas Publishing House (P.) Ltd. New Delhi.
10. Parihar, N.S. (1977). Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
11. Parihar, N.S. (1984). An Introduction To Embryophyta Vol. I Bryophyta. Central Book Depot, Allahabad.
12. Rashid, A. (1996). An Introduction To Bryophyta. Vikas Publishing House Ltd. New Delhi.
13. Saxena, A.K. and Sarbhai, R.M. (1992). A Text Book of Botany Vol. II Embryophyta. Ratan Prakashan Mandir, Agra.
14. Sharma, O.P. (1989). A Text Book of Fungi. Tata McGraw-hill Publishing Company Limited, New Delhi.
15. Sharma, O.P. (1990). A Text Book of Algae. Tata McGraw-hill Publishing Company Limited, New Delhi.
16. Smith, G.M. (1995). Cryptogamic Botany. Vol. II (Bryophytes and Pteridophytes). McGraw-Hill Book Company, New York and London.
17. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
18. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
19. A Text book of microbiology – R.C. Dubey, S.Chand publication pvt ltd.
20. A Text book of microbiology – D.R. Arora, CBC, publication
21. A Text book of Botany – Diversity of microbes and cryptogams – Singh, Pande, Jain Rastogi publication Meerut.

Reference Books:

1. Lee, R.E. (2008), Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Agrios, G.N. (1997), Plant Pathology, 4th edition, Academic Press, U.K.
3. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, 4th ed. 22
4. Prescott's microbiology - Christopher, J. Woolverton, Joanne M. Wiley-McGraw Hill
5. Webster, J. and Weber, R. (2007). Introduction to Fungi. 3rd edition. Cambridge University Press,
6. The Algae World - Dinabandhu Sahoo • Joseph Seckbach Editors Springer 2016

Weblink to Best Reference Books-

https://www.bioexplorer.net/microbiology-textbooks.html/#Best_Microbiology_Textbooks

<https://microbiologynote.com/12-best-books-for-plant-pathology/>

Weblink to Equivalent MOOC on SWAYAM if relevant

<https://swayam.gov.in/explorer>

Weblink to Equivalent Virtual Lab if relevant:

<https://youtu.be/9JwkHjCTKtQ>

(<https://youtu.be/zIVvObvfXdw>

https://youtu.be/0OF8n_sY8as

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Syllabus Prescribed for Three Year UG

Programme: B.Sc.

Semester 1

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
BOT(1S)/BOTANY	Practical	2

COs

After completion of this course successfully , the students would be able to

- 1. Identify and classify the algae on the basis of morphology and other characters.
- 2. Create monograph of Algae and Fungi.
- 3. Demonstrate the structural details of viruses and bacteria included in practical work.
- 4. Evaluate the plant diseases of local plants and diagnosed the diseases on the basis of symptology.

* List of Practical/Laboratory Experiments/Activities etc.

1	Study of types of bacteria from temporary / permanent slides / photographs.
2	Study of TMV and SARS CoV-2 Viruses from Models/ Photographs.
3	Algae - Preparation of temporary mount, identification with reasons of following algal materials : <i>Nostoc, Oedogonium, Chara, Vaucheria, Ectocarpus, Batrachospermum</i>
4	Fungi and Plant Pathology : 1. Study of following Genera - <i>Stemonitis,, Albugo, Rhizopus, Aspergillus. Puccinia, Cercospora,</i> 2. Study of Crustose, Fruticose and Foliose lichen. 3. Study of symptoms of fungal, viral, bacterial diseases. Photographic herbarium of diseased plant parts from local region
Additional Activities	1. Botanical Excursion (short/long) 2. Visit to any biodiversity rich area to study the plant diversity in natural habitat. The botanical excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination
Submission	1. Photographic herbarium of diseased plant plants. 2. Tour reports or field visit report

Faculty: Science and Technology
Programme: B.Sc (Botany)

Syllabus Prescribed for Three Year UG/PG Programme: B.Sc
Semester- II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
BOT(2 S)/Botany	Bryophytes, Pteridophytes, Gymnosperms and Morphology of Angiosperms	60

COs

- After completion of this course successfully , the students would be able to
1. demonstrate on **understanding** of Archegoniate, Bryophytes, Pteridophytes and Gymnosperms.
 2. **identify** and **classify** plants from Bryophytes, Pteridophytes and Gymnosperms.
 3. develop **critical thinking** on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
 4. acquire **skill** of collection and preservation of Bryophytes, Pteridophytes and Gymnosperms

Unit	Content
Unit I: Bryophytes 1.1 General characteristics, affinities with algae and pteridophytes and Classification of Bryophytes by G.M.Smith 1.2 Morphology, Anatomy and Reproduction of i) Marchantiales : <i>Marchantia</i> ii) Anthocerotales : <i>Anthoceros</i> iii) Briales : <i>Funaria</i> 1.3 Ecological and Economical Importance of Bryophytes	12
Unit II: Pteridophytes 2. 1 General characteristics of Pteridophytes 2. 2 Types of Stele in Pteridophytes 2. 3 Classification of Pteridophytes by G.M.Smith 2. 4 Morphology, Anatomy and Reproduction of i) Sphenopsida : <i>Equisetum</i> ii) Lycopsida : <i>Selaginella</i> iii) Filicopsida : <i>Marsilea</i>	12
Unit III: Gymnosperms and Palaeobotany 3.1 General characteristics and affinities of Gymnosperms with Angiosperm 3.2 Classification of Gymnosperms by D.D. Pant 3.3 Morphology, Anatomy and Reproduction of i)Coniferopsida : <i>Pinus</i> ii)Gnetopsida : <i>Gnetum</i> 3.4 Economic importance of Gymnosperms. 3.5 Process of plant fossilization and types of fossils.	12
Unit IV: Morphology of Angiosperms 4.1Life cycle pattern : Annual, Biennial and Perennial 4.2 Angiosperm plant body : Morphology and Modification of Root and Stem 4.3 Leaf : Types, Modifications , Phyllotaxy, Venation and Stipules 4.4 Inflorescence : Racemose ,Cymose and Special Types 4.5 Flowers: Structure of Flower- Calyx, Corolla, Androecium, Gynoecium and Placentation	12
Unit V: Utilization of Plant Wealth 5.1 Fruits : Morphology and Type 5.2 Morphology, variety and economic importance of 5.2.1 Food plant: Cereal- Wheat (<i>Triticum aestivum</i>) ; Pulses- Pigeon pea (<i>Cajanus cajan</i>), 5.2.2 Spices : Cardamom (<i>Ellataria cardamomum</i>), 5.2.3 Oil yielding plants : Sunflower (<i>Helianthus annus</i>) 5.2.4 Fiber Plants: Cotton (<i>Gossypium sp.</i>), 5.2.5 Essential oils- Plant Description and Uses – Rose (<i>Rosa sp.</i>), Nilgiri oil (<i>Eucalyptus sp.</i>)	12

Unit VI : Traditional Knowledge of Medicinal Plants Morphology, Phytochemistry and medicinal uses of 6.1. <i>Aloe vera</i> 6.2. <i>Adhatoda vasica</i> 6.3. <i>Asparagus racemosus</i> 6.4. <i>Azadirachta indica</i> 6.5. <i>Catharanthus roseus</i> 6.6. <i>Chlorophytum borivillianum</i> 6.7. <i>Emblica officinalis</i> 6.8. <i>Ocimum sanctum</i> 6.9. <i>Rauwolfia serpentina</i> 6.10. <i>Vitex negundo</i> 6.11. <i>Withania somnifera</i> 6.12. <i>Tinospora cordifolia</i>		12
*SEM : Skill Enhancement Module Herbal Technology 1. Definition and Scope of Herbal Technology 2. Overview of “Ayush” 3. Cultivation, harvesting, processing and storage of herbal plant parts and product 4. Morphology and Microscopic Examination. And Preliminary Phytochemistry of i) <i>Catharanthus roseus</i> ii) <i>Ocimum sanctum</i> iii) <i>Azadirachta indica</i> iv) <i>Achyranthes aspera</i> v) <i>Aloe vera</i> COs: On completion of this course the students will able to 1. Understand the herbal technology. 2. Develop the skill for cultivation of plants. 3. Acquire the skill of morphological and microscopic examination of herbal plants. 4. List the major herbs, their Botanical names and chemical constituent’s.		
**Activities		1. Photographic collection and preparation of e-herbarium of medicinal plants 2. Cultivation of herbal medicinal plants in college garden, home kitchen garden. 3. Preliminary phytochemical analysis of Mentioned medicinal plants 4. Microscopic preparation of herbal medicinal plants and its microphotography. 5. Project on local herbal plants to be submitted at the end of session.

Course Material/Learning Resources

Textbooks:

1) A.C. Dutta : Text Book of Botany.
2) Andrews A.N. : Studies in Paleobotany.
3) Arnold C.A. : Introduction of Paleobotany.
4) Bhatnagar S.P. and Moitra A., 1996 : Gymnosperms, New Age International Limited, New Delhi.
5) Bhojwani & Bhatnagar : Embryology of Angiosperms.
6) Coulter M.J. & Chamberlain C.J. : Morphology of Gymnosperms.
7) Cutter E.G., 1971 : Plant Anatomy Experiment and Interpretation Part-II, Organs, Edward Arnold, London.
8) Cutter, E.G. 1969 : Part-I, Cells and tissues, Edward, Arnold, London.
9) Davis P.H., and Heywood V.H., 1993 : Principles of Angiosperm Taxonomy: Oliver and Boyd, London.
10) Eames E.J. : Morphology of vascular Plants.
11) Gangulee&Kar : College Botany Vol.II
12) Gangulee Das and Dutta : College Botany, Vol.I
13) Gifford E.M. and Foster A.S., 1988 : Morphology and Evolution of Vascular Plants, W.H. Freeman &Company, New York.
14) Hartmann H.T. and Kestler D.E., 1976 : Plant Propagation Principles and practices, 3rd edition, prentice Hall of India Pvt.Ltd. New Delhi.
15) Heyhood V.H. and Moore D.M. (Eds) 1984 : Current concepts plant Taxonomy. Academic Press, London.
16) Jeffrey C., 1982: An introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
17) Maheshwari P. : Introduction of Embryology of Angiosperms.
18) Pande B.P. : A Text Book of Angiosperms.
19) Proctor M. and Yeop, 1973 : The Pollination of Flowers, William Collins Sons, London.
20) Radford A.E., 1986 : Fundamentals of Plant Systematics, Harper and Row, New York.
21) Rendle A.B. : Classification of flowering plants, Vol.I&Vol.II.
22) S. Sundar Rajan : College Botany, Vol.II & Vol.III.
23) Saxena and Sarabhai : A Text Book of Botany, Vol.II
24) Sharma O.P. : Gymnosperms.

- 25) Shukla & Mishra :Paleobotany.
- 26) Singh and Jain: Taxonomy of Angiosperms.
- 27) Singh, 4. 1999, Plant Systematics - Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi.
- 28) Sporne K.R.: Morphology of Gymnosperms.
- 29) Sporne K.R., 1965: The Morphology of Gymnosperms, Hutchinson & Company, (Publisher) Ltd. London.
- 30) Stace C.A., 1989: Plant Taxonomy and Biosystematics (2nd Edition Edward Arnold, London.
- 31) Stewart W.N., 1983 :Paleobotany and Evolution of Plants, Cambridge University Press, Cambridge.
- 32) Thomas P., 2000: Trees - Their natural history, Cambridge University Press, Cambridge.
- 33) Trivedi B.S. & Sharma B.B. : Introductory Taxonomy.
- 34) Tyagi&Kshetrapal : Taxonomy of Angiosperms.
- 35) Vasistha P.C.: Gymnosperms.
- 36) Vasistha P.C.: Taxonomy of Angiosperms.
- 37) VyasPurohitGarg : A Text Book of Gymnosperms.
- 38) Walton: An Introduction & Study of fossil.
- 39) Modern Practical Botany, Volume-I, Dr.P.B.Pande, S.Chand Pub., N.W.
- 40) Modern Practical Botany, Volume-II, Dr.P.B.Pande, S.Chand Pub., N.W.
- 41) Modern Practical Botany, Volume-III, Dr.P.B.Pande, S.Chand Pub., N.W. Sahni, K.C. 2000.
- 42) The Book of Indian Trees, 2nd edition. Oxford University Press, Mumbai.
- 43) Schery, R.W. 1972. Plant for Man. 2nd Ed. Englewood Cliffs, New Jersey. Prentice Hall.
- 44) Sharma, O.P. 1996. Hill's Economic Botany (Late Dr.A.F.Hill, adapted by O.P.Sharma) Tata McGraw Hill Co. Ltd., New Delhi.
- 45) Swaminathan, M.S. and Kocchar, S.L. (Eds) 1989. Plants and Society. Macmillan Publication Ltd., London.
- 46) Thakur, R.S., Puri, H.S. and Husain, A. 1989. Major and Aromatic Plants, CSIR, Lucknow.
- 47) Thomas, P. 2000. Trees : Their National History, Cambridge University Press, Cambridge.
- 48). Wagner, H., Hikino, H. and Farnswarth, N. 1989. Economic and Medicinal Plant Research, Vols. 1-3. Academic Press, London.
- 49) Walter, K.S. and Gillett, H.J. 1998. 1997 IUCN Red List of Threatned Plants. IUCN, the World Conservation Union, IUCN, Gland, Switzerland, and Cambridge, U.K.
- 50) A Text Book of Botany –Paleobotany, Gymnosperms, Morphology and Utilization of Plants (2014), Dr.P.W.Deotare, Dr.M.A.Shahezad, Dr.Mrs.U.G.Malode, Dr.U.S.Patil, Dr.Mrs.P.S.Kokate,113 114 Dr.Mrs.S.P.Khodke, Published by NabhPrakashan, Amravati.
- 51) Morphology of Angiosperms and Utilization of Plants, Dr.Shubhangi Ingole, Published by PaygunPublishers, Amravati.

Reference Books:

<https://www.sanfoundry.com/best-reference-books-bryophyta-pteridophyta-gymnosperm-palaeobotany/>
https://link.springer.com/chapter/10.1007/978-3-662-02604-5_5https://books.google.com/books/about/An_Introduction_to_Archegoniate_Plants.html?id=0Uh1DwAAQBAJ
 WeblinktoEquivalentMOOConSWAYAMifrelevant:
<https://swayam.gov.in/explorer>
 WeblinktoEquivalentVirtualLabifrelevant:
 Anypertinentmedia(recordedlectures,YouTube,etc.) if relevant:
<https://youtu.be/Ru96iXsWpyg>
<https://youtu.be/IczPZPt281E>

Sant Gadge Baba Amravati University,
Amravati Syllabus Prescribed for Three Year UG/PG Programme
Programme: B.Sc

Semester II

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
BOT(2S)/Botany	Bryophytes, Pteridophytes, Gymnosperms and Morphology of Angiosperms, Utilization of Plants	02

COs

By the end of the Lab/Practical Course, generally students would be able to:

- 1) Understand forms of Bryophytes, Pteridophytes and Gymnosperms.
- 2) Acquire the skill of preparation of slides of plant body and reproductive organs.
- 3) Classify and identify different plant parts on the basis of external morphology.
- 4) Describe the plants in technical language.
- 5) develop critical understanding on morphology, botanical names and cultivation practices of economically important plants..

*List of Practical /Laboratory Experiments/Activities etc.

1	Bryophytes : Study of morphology and anatomy of vegetative and reproductive parts of following genera – <i>Marchantia, Anthoceros, Funaria</i>
2	Pteridophyta: Study of morphology and anatomy of vegetative and reproductive parts of following genera – <i>Selaginella, Equisetum, Marsilea</i>
3	Gymnosperms: Study of morphology and anatomy of vegetative and reproductive parts of following genera – <i>Pinus, Gnetum</i>
4	Study of types of fossil.
5	Morphology:- Detail morphological study of following types of plant parts - Root ,Stem , Leaves, Stipule, Inflorescence, Flower , Placentation, Fruits
6	Utilization of plants: Morphology varieties and economic importance of following plants i) Food plants-Wheat ii) Pulses – Pigeonpea iii) Spices- Cardamom iv) Oil yielding plants- Sunflower v) Fiber yielding- Cotton vi) Mentha piperata (only uses) vii) Eucalyptus (only uses)
7	Medicinal plants- . <i>Aloe vera Adhatoda vasica ,Asparagus racemosus , Azadirachta indica, Catharanthus roseus ,Chlorophytum borivillianum Emblica officinalis, Ocimum sanctum , Rauwolfia serpentina., Vitex negundo , Withania somnifera , Tinospora cordifolia</i>
Addition al Activitie s	1. Botanical Excursion (short/long) 2. Visit to any biodiversity rich area to study the plant diversity in natural habitat. 3. The botanical excursion is compulsory for all students and the report of excursion should be submitted at the time of practical examination.

	4. Photographic collection of bryophytic, pteridophytic and gymnospermic plants specimens
Submission	1. Photographic herbarium of Bryophytes, Pteridophytes, Gymnosperms etc. 2. Botanical excursion report

Sant Gadge Baba Amravati University, Amravati

Part A
Faculty: SCIENCE and TECHNOLOGY
Programme: B.Sc. (Botany)
Part B

Syllabus Prescribed for three Year UG Programme: Botany
GENERAL INTEREST COURSE-1
Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
BOT(1S) Botany	GIC-1 / Floriculture and Landscaping	30

- COs
- After completing this course, the students would be able to
- 1. understand techniques of floriculture and landscaping
 - 2. undertake project work, extracurricular activities
 - 3.implement professional skill, knowledge & employability skills while performing jobs.
 - 4. Create landscaping and adapt floriculture as profession or hobby

Unit	Content
Unit I: Floriculture 1.1 Introduction, Importance and scope of Floriculture 1.2 Plant propagation techniques: 1.2.1 Vegetative methods- Rhizome,Corm,Bulb, Sucker, Offset, Tuber, Bulbils 1.2.2 Artificial methods- Budding, Grafting, Cutting, Layering Propagating media and potting techniques. 1.3 Study of flowering annuals, biennials and perennials 1.4 Study of cultivation practices, Disease and pest management of following plants Rose, Chrysanthemum, Gladiolus,Marigold, Gaillardia and Gerbera 1.5 Importance of flower shows and exhibitions 1.6 Commercial production of Floricultural crops, Harvesting, grading, storage, packaging and marketing	15 (periods)
Unit II Unit II: Landscaping(15 L) 2.1 Aim, objectives and importance of landscaping 2.2 Designing map, individual and institutional landscaping. 2.3 Precautions and maintenance for durability of landscaping. 2.4 Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, dam sites, IT parks, corporate. 2.5 Interior scaping: Introduction, Necessity, Role and opportunities. 2.6 Materials used in Interior scape, selection of plants, design and Maintenance.	15 (periods)

Course Material/Learning Resources

Text books:

1. Text book of floriculture and landscaping, Anil K Singh, Anjana Sisodia
2. Objective Floriculture and Landscaping by Desh Raj
3. Introductory Ornamental Horticulture and landscape garden, Rajaneesh Singh and Bijendrakumarsingh
4. GARDEN Revitalizing Ideal Necessities, by Amravati Garden Club
5. Floriculture in India, G S Randhava and A. Mukhopadhyaya
6. Floriculture, Landscaping and Turf Management by Alagarsamy Nithya Devi and Alagarsamy Ramesh Kumar
7. Floriculture and Landscaping –Vol.1 by Naya Udyog and T K Bose
8. Floriculture and Landscaping at a Glance by Laxmi Lal Somani
9. Text Book on Commercial Floriculture and Ornamental Horticulture with Landscape Architecture by Ashok Kumar and Abhinav Kumar
10. Laurie, Alex and Ries, Victor (2004). Floriculture- Fundamentals and Practices. Agrobios, (India), Jodhpur
11. Beckett, Kenneth A (2002). The Encyclopaedia of Garden Plant. Silverdale Book
12. Prasad and Kumar (2005). Commercial floriculture. Agrobios (India) Jodhpur.
13. Dey, S.C. (2000). Pot culture and Rosen. Agrobios (India). Jodhpur.
14. Dey, S.C. (2003). Indore Gardening. Agrobios (India). Jodhpur.
15. Dey, S.C. (2003). Flower from bulbous plant. Agrobios (India) Jodhpur.
16. Gardeners Encyclopaedia of Plant and Flower – the Royal Horticultural society (Dorling Kindersley, London).
17. McDonald, Elvin (2002). The 400 best garden plant. Quantum Books. London.
18. Wyman's Gardening Encyclopedia Donald Wyman, Macmillan, co. London.
19. The Dictionary of Garden Plants in colour with House and Greenhouse plants Roy Hay and P. Synge (R.H.S. Mermaid Books, London).
20. The Books of Flowers Alice M. Coats, Chancellor Press, London.
21. Garden Flowers Joan Compton, Hamlyn publ. Gr. Ltd. London.
22. Handbook of multiplication of plants (1999) L.H. Bailey, Discovery Publ. House, N. Delhi.
23. *Gopaldaswamy Iyengar*: Complete Gardening in India, G.K. Rangan, Bangalore.

Sant Gadge Baba Amravati University, Amravati

Part A

Faculty: SCIENCE and TECHNOLOGY

Programme B.Sc.

Part B

Syllabus Prescribed for three Year UG Programme: Botany

GENERAL INTEREST COURSE-2

Ethnobotany and Ethnopharmacology

Semester- II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
BOT(2S) Botany	GIC-II / Ethnobotany and Ethnopharmacology	30

COs

After completion of this course, student would be able to

1. Appreciate the need to conserve floristic and cultural diversity of the region.
2. Rescue and document Ethnobotanicals for sustainable use of plant resources.
3. Understand the need for development of new drugs for safe and more rational use of herbal preparations.

4. develop laboratory skills in testing of herbal drugs and new commercial products.

Unit I: Ethnobotany	Content
1. 1 Introduction, relevance, scope and status of Ethnobotany. Methods and techniques used in Ethnobotany - Field level activities for data collection- Approach, Documentation (Audio, Video recording, Photographs, Interview – Methods, Questionnaire, and Data sheet), Authentication of plantspecies (Field Book, Herbarium) Field and Lab Procedures, Peoples biodiversity Register (PBR). 1. 2. Impact of Ethnobotany in herbal-medicine industry, land-use development, agriculture, forestry, betterment of rural livelihoods and education. Biodiversity and conservation of some useful medicinalplants. 1.3.Plant used in ethno medicine- e.g.: Guggul (<i>Commiphora</i>), Musali (<i>Chlorophytum borivilum</i>) Salai guggul (<i>Boswellia serrata</i>) Arjuna (<i>Terminalia arjuna</i>), turmeric (<i>Curcuma longa</i>) Preparation and their uses	15 (periods)
Unit II: Ethnopharmacology 15 Lecture 2.1 Introduction, scope and relevance of Ethnopharmacology. Brief account of Phytochemistry, pharmacodynamics and pharmacokinetics. Classification and sources of crude drugs. Quality, safety and efficacy of herbal medicines/ neutraceuticals 2.2 Biological screening of herbal drugs - introduction and need for phytopharmacological screening: Antimicrobial screening of herbal drugs, Screening for anticancer activity, Screening for antioxidant activity, Screening for Antiurolithiatic. Screening for anti-inflammation and analgesic activity, Screening for antiulcer activity, Screening for antidiuretic activity, Screening for liver related disorders. Database on pharmaceutical uses of plants. 2.3 Plants used by ethnic groups as food, medicines (Ethnomedicine), beverages, fodder, fibre, resins, oils, fragrances and other uses. NWFP (Non-Wood Forest Produces), animal products, minerals, artifacts, and rituals, used by Tribal and Folk Communities of Melghat (Amravati ,Maharashtra) 2.4 Role of ethnomedicine and its scope in modern times. 2.5 Role of Ethnobotany in conservation and sustainable development	15 (periods)

Course Material/Learning Resources

Suggested Readings

- 1) Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press.
 - 2) AYUSH (www.indianmedicine.nic.in). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
 - 3) CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). Aush Gyanya: Handbook of Medicinal and Aromatic Plant Cultivation.
 - 4) Dev, S. (1997). Ethnotherapeutics and modern drug development: The potential of Ayurveda. *Current Science* 73:909–928.
 - 5) Jain, S.K. and Jain, Vartika. (eds.) (2017). Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi
 - 6) Saroya, A.S. (2017). Ethnobotany. ICAR publication.
 - 7) Thakur, R. S., H. S. Puri, and Husain, A. (1989). Major medicinal plants of India. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.
 - 8) Traditional plant medicines as sources of new drugs. P J Houghton in Pharmacognosy Trease and Evan's. 16 Ed .2009
 - 9) Cunningham, A. B. (2001). Applied Ethnobotany. Earthscan publishers Ltd. London & Sterling, VA, USA Cotton, C.M. (1996).
 - 10) Ethnobotany-Principles and application. John Wiley& Sons Ltd., West Sussex, England
 - 11) In vivo and in vitro assays Glimpses of ethnopharmacology 1994 Eds. P Pushpangadan ,V George and U.Nyman
 - 12) Faulks, P.J. (1958). An introduction to Ethnobotany, Moredale Publ. London
 - 13) Jain, S. K. (1981). Glimpses of Indian Ethnobotany. Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
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Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B.Sc. (Chemistry)

POs:

At the time of graduation, Students would be able to

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

Upon completion of the programme successfully, the learners would be able to-

1. Understand the scope, methodology and application of modern chemistry.
2. Apply theoretical and practical concepts of instruments that are commonly used in most chemistry field.
3. Plan and conduct scientific experiments and record the results of such experiments.
4. Get acquainted with safety of chemicals, transfer, and measurements of chemicals, preparation of solutions, and using physical properties to identify compounds and chemical reactions.
5. Describe how chemistry is useful to solve social, economic and environmental problem and issues facing our society in energy, medicine, and health.

Employability Potential of the Programme:

A degree in Chemistry is an intelligent choice for future employability and earning potential for learners. Degree program with Chemistry offers the necessary knowledge, develop skills and nurture creativity to achieve success in virtually any field that's even distantly related in some way to chemistry. A degree in chemistry is recognized as a symbol of quality and commitment by employers both inside and outside the chemical industries. Chemistry provides jobs in cutting-edge technologies within science and research as well as in many fields of distant relations. Chemistry graduates apply their skills within the areas of environmental sciences, medical fields, scientific equipment sales, science communication, teaching or academic research, a few to mention. Thus, a degree in chemistry widens numerous prospects and opportunities for a wide

variety of careers in many different fields like science, research, business and health care, etc. Chemistry inculcates excellent analytical and mathematical skills, which lead to enhanced problem-solving abilities and critical thinking. This improves the likelihoods to secure job in other fields too. Some important skills and abilities honed by chemistry learners include:

- Cutting-edge scientific and numerical skills
- Curiosity to understand and solve
- Attention to collect and analyse details
- Patience and determination
- Research and development skills
- Analytical skills
- Use of ICT enabled techniques
- Written and oral communications skills

The thriving and widely recognized branches of chemistry like Organic, Inorganic, Physical, Analytical, etc. not only expand critical thinking and the ability to understand other scientific and engineering concepts more easily, but also open new horizons to pursue career in different fields. Organic chemistry offers research and development of organic materials, modify and study carbon-based materials to develop a product having a specific purpose for wider use. They also accomplish various scientific studies to identify or find applications for compounds for society. Many industries like pharmaceuticals, agriculture, paints, dyes, and many more prefer to employ organic chemists. Inorganic chemistry has a greater potential in the fields of metallurgy, synthesis of new materials from different elements, bioinorganic, etc. It focusses on solving the fundamental problems associated with structure of atoms, molecules and their properties. Analytical chemists find their role for toxicology examinations, quality control and assessment, analysis of pharmaceuticals, investigations for forensic analysis, development of equipment, etc. Analytical chemists work for a particular private or government laboratory or organization, and also develop particular specialties like food technology, forensics or toxicology, to name a few. Physical chemistry enhances critical ability and inculcates problem solving skills among the learners. All industries rely heavily on physical parameters for manufacturing and quality assurance of products.

Apart from the technical and specific skills, a chemistry graduate also acquires fundamental professional skills throughout the degree program to pursue careers not directly related to the field. These skills include:

- Effective listening and communication skills
- Presentation and interaction skills
- Data collection, analysis and reporting skills
- Modern ICT enabled skills
- Aptitude to work proficiently independently or in a team

Future scope for B.Sc. Chemistry graduates:

- Prestigious institutions like IIT, NIT, IISER, IISc, BARC, TIFR, a few to mention, offer higher studies such M.Sc. and Ph.D.
- Likewise, foreign Universities also accept chemistry graduates for higher studies.
- Chemistry student can become small or medium scale entrepreneur (own industry).
- Union and State Public service commissions like UPSC, MPSC, Bank Probationary officers, other competitive examinations, etc. offer a multitude of jobs and positions like Drug Inspector, Lab chemist, forensic analyst, etc. for chemistry graduates.
- Students can take teaching jobs at Kendriya Vidyalaya, Navodaya Vidyalaya, High Schools after completing B.Ed. or respective eligibility criteria.
- Laboratory technician in various Public Sector Units like ONGC, IOCL, NTPC, BARC, and Private sector industries.
- Students can become Content Developer for IT industries.
- Students can become Quality Control Chemists/ Food Inspector at Food Co-operation of India, Food Safety and Standards etc
- Laboratory technicians to look after sophisticated instruments like NMR, Mass Spectrometer, UV-Visible Spectrophotometer, Single crystal machines, XRD, SEM, AAS, TEM etc. in research laboratory of academic institutions as well as private sector companies

- Research Scientist/ Operations Manager/ Chemists / Quality Manager / Research Manager at various industries like Pharmaceuticals, Cement, Plastic, Drugs, Paint, Dyes, Agricultural sector, etc.
- Employee at Security Printing and Minting co-operation of India
- Employee at Office of Controller general of Patent design and trade work

Syllabus Prescribed for Three Year UG/PG Programme

Programme:

Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
CHE(1S)T	Chemistry 1S	84

COs:

By the end of this course, the students would be able to:

1. Solve the conceptual questions using the knowledge gained by studying periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements.
2. Apply concepts of acids and bases as well as non-aqueous solvents and their industrial usage.
3. Compare different reaction intermediates, functional group chemistry through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
4. Choose correct synthetic approach to prepare derivatives of industrially important molecules
5. Solve different numerical problem of varying difficulty associated with gaseous and liquid state.
6. Apply the concepts from advanced mathematics to solve the derivation of different chemical formulae.

Unit	Content
Unit I	Periodicity of Elements: s and p block elements: Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle. Shapes of s and p orbitals. Electronic configuration for s and p block elements. Detailed discussion of the following properties of the elements, with reference to s and p-block. (a) Nuclear charge and number of shell and its variations (b) Atomic and ionic radii and their variations (d) oxidation states (e) Ionization potential, Successive ionization potential and its variations. (f) Electron affinity and its trends. (g) Electronegativity and its variations. Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties. Diagonal relationships: Li with Mg, B with Al. Abnormal behavior of nitrogen. Periods: 14
Unit II	A) Acids and Bases- Arrhenius, Bronsted-Lowry, and Lewis's theory of acids and bases, Theory of solvent systems and Lux-Flood concept of acids and bases. Hard and soft acids and bases. Pearson's HSAB or SHAB principle with important applications. B) Nonaqueous Solvents-Requirements of a good solvent. Water as a universal solvent. Physical properties of solvents namely liquid range, dielectric constant, dipole moment, heat of vaporization and solubility behavior. Classification of solvents. Acid base, precipitation, redox, solvolysis and complexation reactions in liquid ammonia. Merits and demerits of liquid ammonia as a solvent. Periods: 14
Unit III	Basics of Organic Chemistry: A) Electronic Displacement and Reactive Intermediates: Inductive, Electromeric, Resonance, Mesomeric effects, Hyperconjugation and their applications, dipole moment, homolytic and heterolytic fission with suitable examples. Electrophiles and nucleophiles. Types, shape and their relative stability of carbocations, carbanions, free radicals and carbenes and nitrene.

	B) Aliphatic Hydrocarbons: Formation and reaction of alkanes, Formation of alkenes and alkynes by elimination reactions (with mechanism of E1, E2, E1cb), Saytzeff and Hofmann eliminations, Reactions of alkenes and alkynes, Diels-Alder reaction. C) Structural isomers: Definition, classification, and examples. Periods: 14
Unit IV	Aromatic Compounds: A) Structural Properties: Aromaticity and Huckel's rule (Benzenoid and Non-Benzenoid compounds), Kekule and Dewar structures, Molecular orbital diagram of benzene, Anti-aromatic and non-aromatic compounds. B) Orientation effect: Effect of substituent groups, Activating and deactivating group, Theory of reactivity and orientation on the basis of inductive and resonance effects. C) Electrophilic aromatic substitution: Halogenation, nitration, sulphonation and Friedal Craft's alkylation/acylation with their mechanism. Periods: 14
Unit V	Gaseous State: Postulates of kinetic theory of gases, Maxwell-Boltzmann distribution of velocities (only qualitative treatment), RMS velocity, Average velocity, Most probable velocity, Relationship between RMS velocity and Average velocity, RMS velocity and Most probable velocity, Mean free path, Collision diameter, Collision number or Collision frequency, Deviation of real gases from ideal behaviour, Explanation of deviations, Derivation of van der Waal's equation for real gases. Critical phenomenon, Andrew's experiment (isotherms of carbon dioxide) Critical constant P_c, T_c, V_c in terms of van der Waal's constant (a, b) Derivation of reduced equation of state, Law of corresponding state, Numerical. Periods: 14
Unit VI	A) Liquid State: Definition of surface tension, Its SI unit and effect of temperature on surface tension, Derivation of expression for relative surface tension by stalagmometer method. Applications of surface tension. Viscosity, definition of coefficient of viscosity, Its SI unit and effect of temperature on viscosity, Derivation of expression for relative viscosity by Ostwald's viscometer method, Applications of viscosity. B) Physical Properties and Molecular Structure: I. Electrical Properties: (i) Polar and non-polar molecules. Dipole moment. (ii) Induced polarization and orientation polarization. Clausius Mossotti equation (only qualitative treatment). (iii) Measurement of dipole moment by temperature and refractivity methods. (iv) Applications of dipole moment for the determination of molecular structure. i.e. percentage ionic character of covalent bonding, molecular geometry, cis-trans isomers, ortho, meta and para isomers of a disubstituted benzene. II. Magnetic Properties: (i) Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism. (ii) Volume, specific, mass and molar susceptibility. Relationship between molar magnetic susceptibility and magnetic moment. (iii) Relationship between magnetic moment and number of unpaired electrons. (iv) Gouy's balance method for determination of magnetic susceptibility. (v) Application of magnetic moment in the determination of molecular structure. (vi) Numerical Periods: 14
*SEM: A) Create models for periodic table or periodic properties, or shape of orbitals, categorization of acids and bases on the basis of various theories, Compare applications of non-aqueous solvents.	

B) Analyze the role of reaction intermediates in different organic reactions, classification of aromatic and non-aromatic compounds with justification. C) Numerical associated with gaseous and liquid state, Applications of van der Waal's equation for other gaseous constants and parameters, Prediction of molecular structures using physical properties, Data collection and analysis for surface tension and viscosity coefficient of different liquids.	
COs: By the end of this module, the students will be able to: 1. Create models associated with periodic table 2. Associate reaction intermediates and functional group chemistry with different types of reaction mechanisms. 3. Solve numerical problem associated with gaseous and liquid state.	
**Activities:	Model creation, Chart preparation, memory maps, Class tests, assignments, project, survey, group discussion, industrial visit, or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.

Course Material/Learning Resources

Text books:

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- Vishal Publications, Delhi.
2. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
3. A Text Book of Chemistry for first Semester of B.Sc. by AUCTA Association and DnyanPath Publication, Amravati

Reference Books:

1. Inorganic Chemistry by A.K. De, Wiley East Ltd.
2. Inorganic Chemistry by Meisler and Tarr, 4th Edition, Pearson Pub.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan, S. Chand & Co.
4. Concise Inorganic Chemistry by J.D. Lee, ELBS.
5. Inorganic Chemistry by J.E. Huheey- and Kettle, Harper & Row.
6. Advanced Inorganic Chemistry, Vol-I, Satya Prakash, Madan, Tuli, Basu.
7. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
8. Organic Chemistry by S.K. Ghosh.
9. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
10. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
11. Organic Chemistry by TWG Solomons, 8th edition, John Wiley
12. Organic chemistry by R. K. Bansal
13. Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.
14. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
15. Principles of Physical Chemistry: Maron and Prutton.
16. Principles of Physical Chemistry: Puri, Sharma, and Pathania.
17. Physical Chemistry: P.W. Atkins, 6th Edn.
18. Physical Chemistry: Levine
19. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
20. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
21. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.

22. Practical Physical Chemistry: Palit and De.
23. Practical Physical Chemistry: Yadao.
24. Practical Physical Chemistry: Khosla.
25. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House, Meerut.

Weblink to Equivalent MOOC on SWAYAM if relevant:

Weblink to Equivalent Virtual Lab if relevant:

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

Syllabus Prescribed for three Year UG/PG Programme

Programme: B.Sc. with Chemistry

Semester 1

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
CHE(1S)PR	Chemistry 1S	Total 26 per Semester

COs

At the end of Lab/Practical course, students would be able to

1. Synthesise different types of organic compounds.
2. Perform the process of filtration, crystallization, melting point, waste management.
3. Understand the effect of orientation effect of a group
4. Skilfully determine the surface tension, viscosity of liquid.
5. Predict the endothermic or exothermic process from heat of solution of a salt.

* List of Practical/Laboratory Experiments/Activities etc.

1	Preparation of Acetyl derivative of aromatic primary amine (aniline or toluidine).
2	Preparation of Benzanilide (Benzoylation).
3	Preparation of Benzoic acid from Benzamide (Hydrolysis).
4	Preparation of Benzoic acid from benzaldehyde (Oxidation).
5	Preparation of phenyl-azo-β-naphthol dye (Diazotisation)
6	Base catalysed Aldol Condensation (Synthesis of dibenzal propanone).
7	Preparation of p-nitroacetanilide from acetanilide.
8	Determination of surface tension of a given liquid using Stalagmometer
9	Determination of the parachor value of -CH ₂ - group (methylene) using Stalagmometer
10	Determination of coefficient of viscosity of aqueous solution of ethanol or polymer at room temperature
11	Determination of unknown percentage composition of given glycerol solution from standard 2%, 4%, 6%, 8% and 10% solutions of glycerol
12	Determination of the heat of solution of KNO ₃ (5% solution)

Note:

- Student should perform the single stage preparation with the help of given procedure.
- Melting point and percentage yield should be reported.
- The sample should be submitted.
- Students should recrystallize the sample with suitable solvent.
- Students should know the reaction and its mechanism of given single stage preparation.

Distribution of Marks for Practical Examination**Time: 4 hours (One Day Examination) Marks: 50****Exercise-I 18****Exercise-II18****Viva-Voce07****Record 07****Total: 50****Syllabus Prescribed for Three Year UG/PG Programme****Programme: B.Sc. with Chemistry****Semester 2**

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
CHE(2S)T	Chemistry 2S	84

COs

By the end of this course, the students would be able to:

- apply the knowledge gained by studying types of bonding, solvation, hybridization and molecular geometries.
- Draw the correct molecular structures, bond order and bond length.
- synthesize commercially important compounds of varying carbon backbone.
- Choose correct synthetic approach to prepare derivatives of industrially important molecules.
- Solve numerical problems related to crystalline state.
- Acquire skills to use chemical kinetics to develop mechanism of chemical reactions.

Unit	Content
Unit I	A) Ionic bonding: Definition of ionic bond. Factors affecting ionic bond formation (energetic of ionic bond formation ionization energy, electron affinity and lattice energy). Born-Haber's cycle to determine lattice energy. Solvation and solvation energy, factors affecting solvation energy. B) Polarization: Definition, polarizing power, polarizability, effect of polarization on nature of bond. Fajan's rules of polarization and its applications. C) Valence bond theory: Directional nature of covalent bond. Hybridization, types of hybridization to explain geometries of BeCl₂, BF₃, CH₄, PCl₅, SF₆ and IF₇ Periods: 14

Unit II	A) VSEPR Theory: Various rules under VSEPR theory to explain molecular geometry (following examples may be taken to explain various rules- SnCl_2, CH_4, NH_3, H_2O, SF_4, ClF_3, XeF_4, XeO_3, PCl_3. Limitations of VSEPR theory) B) Molecular Orbital Theory: Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level diagram. Concept of bond order. MO structure of homonuclear diatomic molecules of namely He_2, H_2, N_2 and O_2. Stability sequence of species of O_2 i.e. O_2, O_2^+, O_2^{2+}, O_2^- and O_2^{2-}. Paramagnetic nature of O_2. MO structure of heteronuclear diatomic molecules viz. NO, HF and CO (Coulson's structure). Explanation of important properties of CO viz. – triple bond, almost nonpolar nature, electron donor and acceptor behavior. Comparison of VB and MO theories. Periods: 14
Unit III	A) Haloalkanes: Vinyl chloride - Synthesis from acetylene and ethylene dichloride, reactions with aqueous and alcoholic KOH, polymerization. Allyl chloride - Synthesis from propylene, reactions with aqueous and alcoholic KOH. Allyl bromide - Synthesis from propylene using NBS, reaction with HBr. Comparison of reactivity of vinyl and allyl chloride. B) Haloarenes: Chlorobenzene - Synthesis from phenol, reaction with acetonitrile. Bromobenzene - Synthesis from silver salt of benzoic acid (Hunsdiecker reaction), Wurtz-Fittig reaction. Iodobenzene - Synthesis from benzene diazonium chloride, Ullmann reaction. Benzyl chloride - Synthesis from toluene and benzene, reactions with Mg and NaCN. Comparison of reactivity of chlorobenzene and benzyl chloride, benzyne intermediate mechanism. C) Polyhydric alcohols: Ethylene glycol - Synthesis from ethylene and ethylene dibromide, reactions with PCl_5, CH_3COOH and acetone, dehydrations using conc. H_2SO_4, ZnCl_2 and phosphoric acid. Pinacol - Synthesis from acetone and α-diketone, Pinacol-Pinacolone rearrangement (mechanism). Glycerol - Synthesis from propylene and 3-chloropropylene, reactions with HNO_3, HCl and Na, dehydration using KHSO_4 Periods: 14
Unit IV	A) Phenols: Phenol - Synthesis from toluene, cumene and salicylic acid, Kolbe's carboxylation reaction, Fries rearrangement, Reimer-Tiemann reaction, bromination, acidity of phenol. B) Ethers and epoxides: Diethyl ether - Synthesis from ethanol, Williamson's synthesis, reactions with cold and hot HI and acetic anhydride. Crown ethers - Brief introduction to crown ethers and its applications. Ethylene oxide - Synthesis from ethylene, ring opening reactions with Grignard reagent, HCN and H_2S, reduction with $\text{Zn} + \text{CH}_3\text{COOH}$, dimerization to dioxane (mechanism). Styrene oxide - Synthesis from styrene, ring opening reactions with acid and alkali, reduction with LiAlH_4. C) Thiols and thioethers: Ethanethiol - Synthesis from ethyl iodide, oxidations with I_2 and H_2O_2. Diethyl sulphide - Synthesis from ethyl bromide, Williamson's synthesis, desulphurization with Raney Ni, decomposition with alkali. Periods: 14
Unit V	Crystalline state: Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles. Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and Miller indices of a lattice planes, calculation of interplanar distance $d(h,k,l)$ from Miller indices in a cubic system. Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.). Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C. Ratio of interplanar distances for 100, 110 and 111 lattice planes in S.C.C., B.C.C. and F.C.C. (No geometrical derivation). Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer

	method for the determination of crystal structure of NaCl and KCl. Anomalous behavior of KCl towards X-ray. Numerical. Periods: 14
Unit VI	Chemical Kinetics: Explanation of terms like rate of reaction, order of a reaction and molecularity. Definition with one example of zero, first and second order reaction. Half-life period of a reaction. Derivation of rate equation for first and second order reaction with equal initial concentration and different initial concentration of a reactant. Characteristics of first and second order reaction. Examples of first and second order reaction and their kinetics study with modified rate equation viz. the reactions (i) decomposition of H_2O_2 , (ii) reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI, (iii) hydrolysis of methyl acetate catalyzed by acid, (iv) saponification of ethyl acetate by NaOH and (v) inversion of cane sugar. Determination of order of a reaction by integration, graphical, equifractional change, vant Hoff's differential method and Ostwald's isolation method. Effect of temperature on reaction rates. Arrhenius equation, activation energy and its determination using Arrhenius equation. Numerical. Periods: 14
*SEM: A) Classify molecules using hybridization, VSEPR theory to predict molecular geometries, sketch Molecular orbital diagram for different molecules. B) Comparative reactivity of halobenzene and benzyl halide, determine industrial uses of phenol, diethyl ether and ethylene epoxide. C) Numerical associated with crystalline state and chemical kinetics, Determination of crystal structure of NaCl and KCl, Determination of order of reactions, and reaction kinetics.	
COs: By the end of this module, the students will be able to: 1. Create models associated with molecular geometries, hybridization, MO diagrams. 2. Develop synthetic routes for halobenzenes and benzyl halides. 3. Solve numerical problems associated with crystalline state and chemical kinetics.	
**Activities:	Model creation, Chart preparation, memory maps, Class tests, assignments, project, survey, group discussion, industrial visit, or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.

Course Material/Learning Resources

Text books:

1. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
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Weblink to Equivalent Virtual Lab if relevant:

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Syllabus Prescribed for three Year UG/PG Programme

Programme: B.Sc. with Chemistry

Semester 2

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
CHE(2S)PR	Chemistry 2S	26 per Semester

COs

At the end of Lab/Practical course, students would be able to -

1. Analyse the given organic compound qualitatively by different tests.
2. Prepare the derivative of the provided substance.
3. Illustrate the practical skills in volumetric analysis.
4. Differentiate types of titrations e.g. acid-base, redox, etc.
5. Comprehend the kinetics of reactions and interpret the experimental data.
6. Calculate, communicate and analyse the result.

*** List of Practical/Laboratory Experiments/Activities etc.**

	Complete analysis of simple organic compounds (like urea, thiourea, benzoic acid, Salicylic acid, oxalic acid, glucose, naphthalene, para-toluidine, benzamide, etc.) containing one or two functional groups involving following steps. i) Preliminary examination ii) Detection of elements iii) Detection of functional groups iv) Determination of melting point v) Preparation of derivative and determination of its melting point vi) Performance of spot test, if any
1	Qualitative analysis of compound-1
2	Qualitative analysis of compound-2
3	Qualitative analysis of compound-3
4	Qualitative analysis of compound-4
5	Qualitative analysis of compound-5
6	To determine the strength of oxalic acid by titration with KMnO_4 .

7	To determine strength of FAS by titration with KMnO_4 using internal indicator.
8	Determination of temporary hardness of water sample.
9	To determine the strength of oxalic acid by titration with KMnO_4 .
10	To determine strength of FAS by titration with KMnO_4 using internal indicator.
11	Determination of order of reaction of hydrolysis of methyl acetate by an acid.
12	To study kinetics of saponification of ethyl acetate by NaOH .

Distribution of Marks for Practical Examination

Time: 4 hours (One Day Examination) Marks: 50

Exercise-I 18

Exercise-II18

Viva-Voce07

Record 07

Total: 50



Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B.Sc. with Computer Science/ Computer Application [Voc/Non Voc] / IT

POs:

After completion of graduation, students will be competent to:

- PO1: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- PO2: Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- PO3: Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO4: Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO5: Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO6: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
- PO7: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

At the end of this program, the students would be able to:

- PSO1: Understand the computer hardware and software.
- PSO2: use the knowledge of software installation.
- PSO3: Select modern computing tools and techniques for programming task.
- PSO4: Identify, analyze, formulate and develop computer-based solutions to meet desired needs within realistic constraints.
- PSO5: Develop databases and perform operations on them.
- PSO6: Identify research and development areas in multiple disciplines.
- PSO7: Design and develop the small web applications.

Employability Potential of the B.Sc. with Computer Science/Computer Application(Voc/Non-Voc)/Information Technology:

The BSc with Computer Science, Computer application and IT helps develop a widely applicable skill set in computing with strong programming and mathematics skills, as well as wide ranging skills in project management, effective presentations and teamwork. Graduate with a portfolio of work fit to present to potential employers. Depending on your chosen pathway, you can focus on particular areas of interest such as programming, web development, design of database design and video games. Graduate with the Computer Science will be able to apply for a range of computational and mathematical jobs in the creative industries, business, finance, education, medicine, engineering and science. Typical job titles include:

- Data analyst
- Assistant Programmer
- Web designer
- Web developer
- Applications developer
- UI Developer
- Cyber security analyst
- Game designer
- Games developer

- Mobile App Developer
- Software Developer

Graduates of BSc Computer Science can find jobs in a variety of sectors like IT departments, MNCs, colleges, etc. in both private and government companies.

Some of the common job sectors, where a fresher and experienced professional can find a relevant job after completing this course are:

IT dept., Consultancies, Technical Support, Cyber Security, Software Engineering, MNCs, Website Development, Mobile App Development, Website Designing, Data Analyzation, Computer Manufacturers, Government Agencies, etc.

Bachelor degree with Computer Science/ Computer Application/IT has become one of the most favoured undergraduate programs for students now a day. A **career in Computer field** has been proved rewarding since last decade. This field has the potential to boost the career. After completing B.Sc in Computer science/ Computer Application/IT, one can always go for higher studies for a better career prospects. They can join Master of Computer Application (MCA) or M.Sc in Computer science course. (MCA and M.Sc – Computer Science are equivalent degrees as recognized by UGC).

India is known to be a leader in software and the IT sector. The software and IT companies are the major employers of computer science graduates and offers the best packages to the young graduates which are unmatched with any other branches of science. Information Technology is a consistently growing field in respect of job opportunities. **Computer science professionals** or software professionals in recent scenario have a very bright career prospect. With growing of IT and software companies, a variety of job opportunities for trained computer professionals are being offered not only in India and abroad as well. IT sector is quite broad in terms of employment and job options, which gives fresher's new opportunities to make successful careers. Computer graduate can also get jobs in non-IT companies like universities, research, private and public industries, government departments, business organizations, commercial organizations and the manufacturing sector, etc.

Future scope for B.Sc. Computer Science/CA and IT graduates:

- Offer higher studies such M.Sc. and Ph.D. , MCA and MBA
- Likewise, foreign Universities also accept computer graduates for higher studies.
- Computer student can become small or medium scale entrepreneur.
- Union and State Public service commissions like UPSC, MPSC, Bank Probationary officers, other competitive examinations, etc. offer a multitude of jobs and positions like Data Entry operator, Assistant Programmer, etc.
- Students can become Content Developer for IT industries.
- Employee at Security Printing and Minting co-operation of India.

Sant Gadge Baba Amravati University, Amravati

Part B

Syllabus Prescribed for 03 Year UG Programme

Programme: B.Sc. Part I (Computer Science/ Computer Application [Voc/Non-Voc]/IT)

Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
1CS1	Fundamentals of Computer and C Programming	84

COs Upon completion of this course successfully, Students would be able to -

1. Understand the computer, I/O and peripheral devices.
2. Understand concept of Operating systems.
3. Apply the Programming concepts.
4. Learn C language.
5. Write Simple C Programs.

Unit	Content
Unit I	Introduction to Computer, Characteristics, Generations of Computers, Block diagram of Computer. Memories: Primary Memories : RAM, ROM, and its types, Cache Memory, Secondary Storage Devices : Hard Disk, SSD, Pen drives. I/O Devices: Keyboard, Mouse, Scanner, Touch Screen, Monitors: LCD & LED. Printers: Impact and non-impact. (14 periods)
Unit II	Operating System: Definition, Functions of Operating System, Types: Batch Mode, Multiprogramming, Time sharing , Online Real Time, Distributed O.S. Booting process. Windows: Introduction, Features and taskbars, Desktop, Customizing Desktop. (14 periods)
Unit III	Programming Concept: Algorithm, flowcharting, Types of programming languages, Programming process: Program design, Coding, Compilation & Execution, Testing & Debugging, Documentation. Structured Programming : History of C language, Advantages, Structure of C program, Character set, Identifiers, Keywords, Constants and Variables, Symbolic constants, Qualifiers, Type conversion. Operators and Expressions. (14 periods)
Unit IV	I/O Operations : Formatted I/O : scanf(), printf() Unformatted I/O : getch(), getchar(), gets(), putchar(), puts(). Control structures: Branching: if, if-else, Conditional operator(? :), nested if, switch. Looping: while, do-while, for statements, comma operator, goto, break, continue, nested loops. (14 periods)
Unit V	Arrays - Declaration and initialization of one and two dimensional array. Structure - Definition, declaration, initialization, array of structure, nested structure, union. Pointers - Declaration, initialization, pointers arithmetic (11 periods)
Unit VI	Functions in C: Introduction, definition of function, function prototype, categories of function, actual argument, formal argument, function calling: call by value, call by reference, function parameters, local and global variable, functions with array, function recursion. String functions - String functions : strlen(), strcpy(), strcmp() & strcat() (14 periods)
*SEM: Assignment, Class test, Study tour, Industrial visit, Group discussion or any other innovative practice/activity	

COs:	
1. To draw flowchart, learn Algorithms and write simple programs. 2. To assess the curricular skills acquired by students at college level through Assignments, Unit test, Internal Test, Group Discussion/Seminar/Mini Project, Study Tour	
Activities	1. Assignment 2. Group discussion 3. Study tour/ Industrial visit (4 periods)

Course Material/Learning Resources

Text books:

- 1) Computer Fundamentals & Networking - P.K.Sinha
- 2) Programming in C: E Balagurusamy : TMH Publication.

Reference Books:

- 1) Fundamentals of Computer - V.Rajaraman
- 2) Computer Network-Andrew Tanenbaum
- 3) ABC of Internet - Christian Crumblish (BPB)
- 4) ANSI C- Dennis Ritchie
- 5) Programming in C - V.Rajaraman
- 6) Programming with C: Venugopal K.R. TMH, Publication.
- 7) Programming with C: Byson Gottfried , Schaum Series Publication.
- 8) Fundamentals of IT and C programming by C H Sawarkar, A P Chendke, G P Gawali Dnyanpath Publication.
- 9) Web Technology and Advance Programming by Dr. P N Mulkalwar, M M Bhonde, A A Tayade. Dnyanpath Publication.

Weblink to Equivalent MOOC on SWAYAM if relevant:

- https://onlinecourses.swayam2.ac.in/cec19_cs06/preview
- https://onlinecourses.swayam2.ac.in/nou20_cs03/preview
- <https://www.classcentral.com/course/swayam-computer-fundamentals-13950>
- https://onlinecourses.nptel.ac.in/noc19_cs42/preview
- https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
- https://onlinecourses.swayam2.ac.in/cec20_cs02/preview
- <https://www.classcentral.com/course/swayam-introduction-to-programming-in-c-2486>
- https://swayamprabha.gov.in/asset/new_team/images/course_files/R12-Introduction%20to%20Programming%20in%20C%20.pdf

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

- https://www.youtube.com/watch?v=eEo_aacpwCw
- <https://www.youtube.com/watch?v=OGM2BJ29Syg>
- https://www.youtube.com/playlist?list=PLWPirh4EWFpF_2T13UeEgZWZHc8nHBuXp



Syllabus Prescribed for –BSc-I Year UG Programme**Programme: B.Sc. Part-I Sem-I (Computer Science / Computer Application [Voc/Non-Voc]/IT)****Semester 1**

Code of the Course/Subject	Title of the Course/Subject	(No. of Periods/Week)
1CSLAB1	Laboratory/Practical of Fundamentals of Computer and C Programming	06 periods per Batch per Week

*** List of Practical/Laboratory Experiments/Activities etc.****Course Name: Fundamentals of Computer and C Programming****COs**

Upon completion of this course successfully, Students would be able to demonstrate/perform/accomplish the following

1. Write word processing task.
2. Create worksheet and perform operations on it.
3. Design, compile and debug programs in C language.
4. Classify conditional expressions and looping statement to solve problems associated with conditions and repetitions.
5. Demonstrate the programs using arithmetic and relational operators.
6. Implement the concept of various string handling functions.
7. Classify programming components that efficiently solve computing problems in real-world.

List of Practical:

1. Practical on Word Processing.
2. Practical on Spread Sheets.
3. Practical on Design of Presentation.
4. Write a program in 'C' to demonstrate Arithmetic Operations.
5. Write a program in 'C' to demonstrate If -Else Statement.
6. Write a program in 'C' to demonstrate Nested If Statement.
7. Write a program in 'C' to demonstrate Else..If ladder Statement.
8. Write a program in C to demonstrate Switch-case Statement.
9. Write a program in 'C' to demonstrate For Loop Statement.
10. Write a program in 'C' to demonstrate Nested For Loop Statement.
11. Write a program in 'C' to demonstrate While Loop Statement.
12. Write a program in 'C' to demonstrate Nested While Loop Statement.
13. Write a program in 'C' demonstrate Do-While Loop Statement.
14. Write a program in 'C' demonstrate Nested Do-While Loop Statement.
15. Write a program in 'C' demonstrate One-Dimensional Array.
16. Write a program in 'C' demonstrate Two-Dimensional Array.
17. Write a program in 'C' demonstrate String Functions.
18. Write a program in 'C' demonstrate Pointers.
19. Write a program in 'C' demonstrate Function.
20. Write a program in 'C' demonstrate Function Recursion.

Weblink to Equivalent Virtual Lab if relevant:

- <https://www.programiz.com/c-programming/online-compiler/>
- https://www.onlinegdb.com/online_c_compiler
- https://www.tutorialspoint.com/compile_c_online.php

Distribution of Marks for Practical Examination**Time: 4 hours (One Day Examination) Marks: 50****Exercise-I15****Exercise-II..... 15****Viva-Voce..... 10****Record 10****Total: 50**

INSTRUCTIONAL GUIDELINES

Laboratory/practical/practicum/hands-on/activity-based learning is a learning that occurs in a space where students can observe, practice, do some activity, get hands-on, get practical training, gain programming knowledge and ideas either individually or in groups. This learning is not confined within a physical laboratory space, but can also occur in various forms of space such as the e-learning management system and computer-simulated virtual laboratories. Within the laboratory, learning may occur in many ways, often through observing a case or phenomena, performing hands-on practical trainings.

Sample Examples for COs of some Lab/Practical Courses are as follows, which may be used for Reference purpose only.

BOS should decide the COs for practical/lab courses/practicum/activities conscientiously.

By the end of the Lab/Practical Course, generally students should be able to:

1. Design Algorithm and flowchart, develop data base, procedure iteratively, reflectively, and responsively
2. Design and execute program, work independently, interpret results, and draw a reasonable, accurate conclusion.
3. Evaluate the process and outcomes of an experiment quantitatively and qualitatively,
4. Communicate the process and output of program and
5. Design Conduct an experiment collaboratively and ethically.

Part B**Syllabus Prescribed for 2022-23 Year UG Programme****Programme: B.Sc. I Semester – II (Computer Science /
Computer Application [Voc/Non-Voc]/IT)**

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
1CS2	Data Structure and OOPS	84 Periods

COs

Upon completion of this course successfully, Students would be able to -

1. Implement basic data structures such as arrays, stacks.
2. use linked list, trees and queues.
3. Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
4. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.
5. Perform programming on functions, inline functions, constructor and destructor.
6. Perform programming on the concept of function overloading, operator overloading, virtual functions and polymorphism.

Units	Content	
Unit I	Data structure: Introduction to data structure, Types of data structure: Primitive and Non-primitive, Linear and Non-linear data structure, Data structure operations. Array: Definition and concepts, Memory Representations, Operations: Traversing, Insertion, Deletion. Stacks: Definition and concepts, Memory Representations, Operations: Traversing, Insertion, Deletion.	14 (Periods)
Unit II	Queue: Definition and concepts, Memory Representations, Operations: Traversing, Insertion, Deletion. Types of Queue. Linked List: Definition and concepts, Memory Representations, Types of Linked List, and Operations: Traversing, Insertion, Deletion. Tree: Definition and Terminologies, Memory Representations of Trees, Types of Trees : Binary Trees, Complete Binary Trees, Binary Search Trees, Traversing : Preorder, Inorder, Postorder, Insertion, Deletion.	14 (Periods)
Unit III	Searching and Sorting: Definition and concept. Searching Techniques: Linear Search, Binary Search and Indexed Sequential Search. Sorting Techniques: Bubble Sort, Selection Sort, Insertion Sort, Radix Sort, Merge Sort and Quick Sort.	14 (Periods)
Unit IV	Object Oriented Programming: Features, Advantages and Applications of OOPS. Comparisons between POP and OOP, Introduction to C++, Program structure in C++. Classes and Objects: Classes and Objects Specifiers, Defining data member and member functions, Accessing members. Managing Console I/O: Formatted and Unformatted, Usage of manipulators: endl & setw, Scope Resolution Operator.	14 (Periods)
Unit V	Functions in C++: Passing objects to and returning objects from functions. Function Overloading and Default argument, Inline function, Friend function. Array of Objects, Pointer to objects, 'this' pointer. Constructor and Destructor: Types of constructor, Usage of Constructor.	14 (Periods)
Unit VI	Operator Overloading: Definition, Overloading Unary and Binary operators. Inheritance: Definition, Types of Inheritance, Visibility mode; Types of inheritance with example, Virtual base classes and Abstract base classes.	14 (Periods)

*SEM : Assignment, Class test, Study tour, Industrial visit, Group discussion or any other innovative practice/activity	
COs: 1. Acquire skill to work with core components of data structure 2. Acquire object oriented programming skill.	
**Activities	1. Assignment 2. Group discussion 3. Study tour/ Industrial visit

Course Material/Learning Resources

Text books:

1. Object Oriented Programming with C++ : E Balagurusamy TMH
2. Data Structures , Seymour Lipschutz , Schaum's Outlines Series, Tata McGraw-Hill.
3. Text Book of Computer Science (Data Structure and C++): S D Pachpande, R B Ghayalkar and Athar Iqbal, Dnyanpath Publication.

Reference Books:

1. Fundamentals of Data Structures in C, Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed. W. H. Freeman and Company.
2. Object-Oriented Programming in C++, Fourth Edition, Robert Lafore, SAMS Publication.
3. Data Structure and Algorithms :Aho, Hopcroft, Ulman
4. Introduction to Data Structure : Bhagat Singh, Thomas L Naps
5. Mastering in C++ by K. R. Venugopalan.
6. Data Structure and C++: P.S.Bodkhe, A.A.Tayade, S.B.Agarmore, Dnyanpath Publication.

Weblink to Equivalent MOOC on SWAYAM if relevant:

1. https://onlinecourses.swayam2.ac.in/cec22_cs19/
2. https://onlinecourses.nptel.ac.in/noc22_cs92/
3. https://onlinecourses.nptel.ac.in/noc22_cs70/

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

1. <https://www.youtube.com/watch?v=RBSGKIAvoiM>
2. <https://www.youtube.com/watch?v=zg9ih6SVACc>

Syllabus Prescribed for 2022-23 Year UG Programme

**Programme: LAB 2 B.Sc. I Semester II (Computer Science /
Computer Application [Voc/Non-Voc]/IT)**

Semester - II

Code of the Course/Subject	Title of the Course/Subject	(Number of Periods/Week)
1CSLAB2	Data Structure and OOPs	06 Periods/Batch per week

Course name: Data Structure and OOPs lab
COs

Upon completion of this course successfully, Students would be able to demonstrate/perform/accomplish the following

1. Perform various operations Data structure using CPP.
2. Develop the concept of dynamic memory allocation through linked list.
3. Design stack and queue with contiguous and non-contiguous data storage mechanism.
4. Perform the various operations on binary tree.
5. Implement sorting on 1-D array using different techniques.

Practical List of Data Structure

1. Write a Data Structure program in C to insert the element into the STACK using PUSH operation.
2. Write a Data Structure program in C to delete the element from the STACK using POP operation.
3. Write a Data Structure program in C to insert the element into the QUEUE.
4. Write a Data Structure program in C to delete the element from the QUEUE.
5. Write a Data Structure program in C to insert the node into the Linked List.
6. Write a Data Structure program in C to delete the node from the Linked List.
7. Write a Data Structure program in C to demonstrate the Linear Search.
8. Write a Data Structure program in C to demonstrate the Binary Search.
9. Write a Data Structure program in C to demonstrate the Bubble Sort.
10. Write a Data Structure program in C to demonstrate the Sorting Algorithms.

Practical List of Object Oriented Programming language

1. Write a program in C++ to demonstrate Class and Object.
2. Write a program in C++ to demonstrate constructor and destructor.
3. Write a program in C++ to demonstrate Inline function.
4. Write a program in C++ to demonstrate the use of friend function.
5. Write a program in C++ for default argument.
6. Write a program in C++ for unary operator overloading.
7. Write a program in C++ for Binary operator overloading.
8. Write a program in C++ for function overloading.
9. Write a program in C++ for virtual base class.
10. Write a program in C++ to implement the Inheritance.

Weblink to Equivalent Virtual Lab if relevant:

1. <http://cse01-iiith.vlabs.ac.in/>

Distribution of Marks for Practical Examination

Time: 4 hours (One Day Examination) Marks: 50

Exercise-I15

Exercise-II..... 15

Viva-Voce..... 10

Record 10

Total: 50

By the end of the Lab/Practical Course, generally students should be able to:

1. Collect data and revise the experimental procedure iteratively, reflectively, and responsively
2. Design and execute an experimental procedure, work independently, interpret experimental results, and draw a reasonable, accurate conclusion.
3. Evaluate the process and outcomes of an experiment quantitatively and qualitatively,
4. Extend the scope of an investigation whether or not results come out as expected,
5. Communicate the process and outcomes of an experiment, and
6. Conduct an experiment collaboratively and ethically.

Sant Gadge Baba Amravati University, Amravati

Faculty of Science and Technology

Programme: B.Sc. Electronics Science

Program Outcomes (POs):

At the end of the programme, students would be able to

- 1) Utilize the basic knowledge in Electronics science.
- 2) Identify electronic components and ICs.
- 3) Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns
- 4) Apply research based knowledge to design and conduct experiments
- 5) Construct, choose and apply the techniques, resources and modern electronics tools required for Electronics applications.
- 6) Apply the contextual knowledge to assess societal, health, safety and cultural issues and endure the consequent responsibilities relevant to the professional electronics practice.
- 7) Examine the impact of electronics solutions in global and environmental contexts and utilize the knowledge for sustained development.
- 8) Develop consciousness of professional, ethical and social responsibilities as experts in the field of Electronics and Communication.
- 9) Perform effectively as a member/leader in multidisciplinary teams.
- 10) Demonstrate resourcefulness for contemporary issues and lifelong learning.

Program Specific Outcomes:

Upon completion of the programme successfully, students would be able to

1. acquire knowledge in fundamental aspects of all branches of Electronics
2. create inquisitiveness and problem-solving skills
3. apply the principles of Electronics in solutions to real world problems
4. get prepared for higher education and career in Electronics
5. develop skills in the proper handling of apparatus and components
6. apply Electronics in their day to day life
7. act as a responsible citizen
8. Select and apply cutting-edge engineering hardware and software tools to solve complex Electronics and Communication Engineering problems
9. Apply the fundamental concepts of electronics and communication science to design a variety of components.

Employability Potential in Electronics:

Bachelor of Science in Electronics is a technical course comprising the study of electronic devices, the materials used in the manufacturing and production of these devices and their composition. A degree in electronics can give you the skills and knowledge to understand the various features of electronic devices and circuits and how they function. Course is Divided across six semesters, the course may include subjects such as basic mathematics, the fundamentals of electricity, electronics and electronic communication, physics, environmental studies and value education. Depending on the college and its syllabus, students can also pick other elective subjects such as Mathematics, Physics, Computers, Statistics etc.

1. Field service engineer
2. Electrical technician
3. Sound technician
4. Telecommunications engineer
5. Technical support executive
6. Electronic sales manager
7. Electrical supervisor
8. Software test engineer
9. Software engineer
10. Automation engineer

Areas of employment include but not limited to:

- IT companies
- Hardware manufacturing industry
- Telecommunication industry
- Defense sector
- Banking sector
- Tourism industry

Further studies after B.Sc. in Electronics

- M.Sc. (Master of Science) in Electronics Instrumentation
- M.Sc. (Master of Science) in Applied Electronics
- M.Tech. (Master of Technology) Electronics and communication
- Ph.D in Electronics Science
- Diploma in Bio-Medical Electronics
- Diploma in Mechatronics

Key skills required for jobs after B.Sc. in Electronics

A bachelor's degree in electronics can lead you to job opportunities in both the public and private sectors. Apart from the technical knowledge and skills that you may gain during the course of your professional degree, graduates in electronics may require soft skills to excel, regardless of the industry or field they choose to work in. Some of these soft skills include:

- problem-solving skills
- methodical thinking
- critical thinking
- communication skills
- time management skills
- ability to plan and prioritise work
- leadership skills
- dependability
- ability to work in a team
- adaptability
- good work ethics

Semester I
DSC -1S- Electronics
Course Title - Basic Electronics

Unit I : Passive Components and Network theorems (12L)

Introduction to Resistors, Capacitors, Inductors and Transformers, Concept of ideal dc voltage and current source, KVL, KCL, Thevenin's, Norton's, maximum power transfer, Millman's theorem (statement, proof, simple numerical application for dc only).

UNIT II: Measuring Instruments : (12L)

Principles of voltmeter, ammeter, ohmmeter, Multirange DC voltmeter, ohm per volt rating, loading effect, Multirange DC Ammeter, Series & shunt type ohmmeter, Multimeter (uses & drawback). CRO Block diagram & explanation, CRT construction & working, uses of CRO (measurement of frequency, amplitude & phase.)

Unit III : Semiconductor Diode and Regulated power supply: (12L)

Operation and characteristics of PN junction diode, Avalanche and Zener breakdown mechanism, Half wave and full wave rectifiers (ripple factor, efficiency, PIV ratings), C, L and p filters, Concept of unregulated and regulated power supply, Zener diode voltage regulator, Three terminal IC regulator.

Unit IV : Bipolar Transistors: (12L)

NPN and PNP transistor (construction and working) CB, CE & CC configuration, leakage currents, Input and output characteristics of CE mode, relation between α and β Load line and operating point, Amplification action of CE amplifier, biasing and stability, Self and fixed bias circuit.

Unit V : Switching and Optoelectronic devices : (12L)

Construction, working and characteristics of FET, MOSFET, UJT, SCR, relation of FET parameters, Construction, working & characteristics of LDR, LED, photodiode, photovoltaic cell(Solar cell).

Unit VI : Integrated Circuits: (12L)

Introduction to IC technology, advantages and disadvantages, Classification of ICs, Basic steps in fabrication of monolithic ICs, Fabrication of diode, resistor & transistor. Scale of integration upto VLSI, Basic concept of Embedded systems.

Unit VII : DSC-1S-SEM (18L)

- Identification of testing tools.
- Idea of Phase, Neutral and Ground of AC mains.
- Use of soldering iron.
- Use of Desoldering pump.
- Identification of Active and Passive electronic components in simple way.
- Identification of step-up and step down transformer.
- Measurement of voltage.
- Measurement of current.
- Measurement of resistance.
- Identify and measurement of capacitance of various capacitors.
- Identify the control and functional switches in CRO .
- Study of Resistors and Capacitors in series.
- Study of Resistors and Capacitors in parallel.
- Testing and fault finding of transistor.

COURSE OUTCOMES

DSC-1S

Sr.No.	Topic	What the student will be able to do at the end of Module/Unit (Knowledge/ Skill achieved OR Application of Knowledge /Skill to do what) /COs
1	Unit I : Passive Components and Network	At the end of this unit, students will be able

	theorems Introduction to Resistors, Capacitors, Inductors and Transformers, Concept of ideal dc voltage and current source, KVL, KCL, Thevenin's, Norton's, maximum power transfer, Millman's theorem (statement, proof, simple numerical application for dc only).	to know passive and active components, analysis and verification of network theorems with numericals. Also students will be able to select and identify electronic components such as resistors capacitors etc. of required value.
2	UNIT II: Measuring Instruments : Principles of voltmeter, ammeter, ohmmeter, Multirange DC voltmeter, ohm per volt rating, loading effect, Multirange DC Ammeter, Series & shunt type ohmmeter, Multimeter (uses & drawback). CRO Block diagram & explanation, CRT construction & working, uses of CRO (measurement of frequency , amplitude & phase.)	After this unit, students will be able to understand principle and working of different meters and CRO . They will be able to handle and connect the measuring instruments such as Voltmeter, Ammeter etc. at appropriate place
3	Unit III : Semiconductor Diode and Regulated power supply: Operation and characteristics of PN junction diode, Avalanche and Zener breakdown mechanism, Half wave and full wave rectifiers (ripple factor, efficiency, PIV ratings), C, L and filters, Concept of unregulated and regulated power supply, Zener diode voltage regulator, Three terminal IC regulator.	At the end of this unit, students will be able to know function of diodes, rectifiers and voltage regulators. They will be able to design simple dc power supply.
4	Unit IV : Bipolar Transistors: NPN and PNP transistor (construction and working) CB, CE & CC configuration, leakage currents, Input and output characteristics of CE mode, relation between Load line and operating point, Amplification action of CE amplifier, biasing and stability, Self and fixed bias circuit.	After completion of this unit, students will be able to know types transistor and their working in different modes, amplification and biasing, faults detection in electronic circuits. Also they will be able to design and construct simple amplifiers.
5	Unit V : Switching and Optoelectronic devices : Construction, working and characteristics of FET, MOSFET, UJT, SCR, relation of FET parameters, Construction, working & characteristics of LDR, LED, photodiode, photovoltaic cell(Solar cell). concept of Embedded systems.	At the end of this unit, students will be able to know Switching and Optoelectronic devices and their working. They will be able to use these active devices for many applications.
6	Unit VI : Integrated Circuits : Introduction to IC technology, advantages and disadvantages, Classification of ICs, Basic steps in fabrication of monolithic ICs, Fabrication of diode, resistor & transistor. Scale of integration upto V2LSI, Basic	After completion of this unit, students will be able to know design and fabrication process of ICs and their scale of integration

Books Recommended:

- 1) Basic electronics by B.L.Thereja (S.Chand and Company)
- 2) Digital and Analog technique by Navneet, Kale and Gokhale
- 3) Element of electronics by Bagde and Singh (S.Chand and Company)
- 4) Principles of electronics by V.K.Mehta
- 5) Introduction to digital electronics by Mohinder Singh
- 6) Electrical and electronics measurement and Instrumentation by A.K.Sawhney
- 7) Text book of Electrical Technology by B.L.Thereja

Practicals: Minimum Ten experiments at least one on each of the following aspects.

1. Active and Passive components.
2. Network theorems, voltmeter, Ammeter, ohmmeter multimeter and CRO.

3. Regulated power supply, rectifiers, filters, IC regulators.
4. Bi-polar devices and its applications.
5. Uni-polar and optoelectronic devices and its applications.
6. IC testing, IC know how, IC connection, simple IC circuits, mounting of IC on PCB and checking of voltage at each pin.

Semester II
DSC -2S- Electronics
Course Title - Digital Electronics

Unit I : Binary Arithmetic & Logic gates : (12L)

Binary, Octal & Hexadecimal number system and their interconversion, Binary arithmetic (addition and subtraction using 1's & 2's complement), multiplication & division. Binary codes : 8421 BCD, Excess-3 & Gray code. NOT, OR, AND, NAND, NOR gates (definition and truth table). EXNOR & EXOR gates, Half adder, full adder, 4 bit binary full adder.

Unit II : Boolean Algebra & Logic families: (12L)

Boolean laws, De-Morgan's theorem, Simplification of Boolean equations using Boolean algebra, Fundamental products & sum terms, K-map (K-map upto 4 variable). Classification of logic families, characteristics (Fan-in, Fanout, Noise immunity, Propagation delay, Power dissipation), DTL, TTL & CMOS logic.

Unit III : Multivibrators and Flip Flops: (12L)

Construction & working of Astable, monostable and Bistable transistorised multivibrators, RS, CK-RS, D, JK, JKMS and T Flip Flops (Logic diagram, Truth table, construction & working), Concept of edge trigger Flip-Flop, Concept of preset & clear terminal.

Unit IV : Counters and Shift registers: (12L)

Asynchronous & synchronous Counter, Up-down counters (up to 4-bits), modified asynchronous counter (Mod - 7, Mod- 10, and Mod-13). Types of shift registers, SISO, SIPO, PISO & PIPO, IC version of Mod -10 shift registers (Construction & working), IC version of shift register – 7495, Application of shift register. Ring counter, Johnson's counter.

UNIT V: Combinational logic circuit: (12L)

Encoder: Binary to BCD, Decimal to BCD, IC 74147, Decoder: 2 to 4 line, BCD to decimal, BCD to 7 segment, IC 7447, Multiplexer: 4X1, 8X1, De multiplexer: 1X4, 1X8, (Definition, construction, operation and application of above)

Unit VI : Semiconductor Memories: (12L)

Concept of memory, primary and secondary memory, classification of memories, volatile and non volatile memories, memory Hierarchy, semiconductor memory: RAM, ROM, PROM, EPROM, EEPROM, flash memory.

Unit VII : DSC-2S-SEM (18L)

- Illustrate to practice the digital trainer kit with safety.
- Identify various digital ICs.
- To test IC using digital IC tester.
- Identification of ICs NOT, OR and AND.
- Identification of ICs NAND, NOR, EXNOR and EXOR.
- Skill to convert decimal number in to binary by using 8421 BCD code.
- Skill to convert the given number into the specified number system.
- Identification of base or radix of Binary, Octal, Decimal and Hexadecimal number system.
- Construct and verify the truth table of all gates using NOR and NAND gates.
- Skill of Subtraction by using 1s complement.
- Skill of Subtraction by using 2s complement.
- Construct an adder cum subtractor circuits and verify the truth table.
- Study of Boolean algebra.
- Study of De-Morgan's theorem.
- Study Characteristics of logic families Noise margin, Power dissipation, Figure of merit, Fan in and Fan out.
- Skill the K-map reduction technique for the Boolean expression.
- Study of IC 7483 adder.
- Construct Encoder and Decoder by using IC74147, IC7447 and verify the truth

table.

- Construct multiplexer and demultiplexer circuits and verify the truth table.
- Triggering methods- edge trigger and level trigger.
- Construct and verify Asynchronous, Synchronous and Up-Down counter.
- Construct and verify the truth table of SR Flip Flop, Clocked SRFF with preset and clear.
- Construct and verify shift registers SISO, SIPO, PISO and PIPO.
- Identification of primary memory.
- Identification of secondary memory.

COURSE OUTCOMES

DSC-2S

Sr.No.	Topic	What the student will be able to do at the end of Module/Unit (Knowledge/ Skill achieved OR Application of Knowledge /Skill to do what) / COs
1	Unit I : Binary Arithmetic & Logic gates : Binary, Octal & Hexadecimal number system and their inter- conversion, Binary arithmetic (addition and subtraction using 1's & 2's compliment), multiplication & division. Binary codes : 8421 BCD, Excess-3 & Gray code. NOT, OR, AND, NAND, NOR gates (definition and truth table). EXNOR & EXOR gates, Half adder, full adder , 4 bit binary full adder.	After completion of this unit, students will be able to know number systems and binary codes, their interconversion and arithmetic, logic gates, use of logic gates in adders. They will be able to design and construct logic circuits using logic gates.
2	Unit II : Boolean Algebra & Logic families: Boolean laws, De-Morgan's theorem, Simplification of Boolean equations using Boolean algebra, Fundamental products & sum terms, K-map (K-map upto 4 variable). Classification of logic families, characteristics (Fan-in, Fan- out, Noise immunity, Propagation delay, Power dissipation), DTL,TTL & CMOS logic.	At the end of this unit, students will be able to understand Boolean algebra, De'Morgan's theorem, logic equations, K-map and logic families like DTL,TTL etc. They will be able to minimise logic equation, design and construct logic circuits using logic gates.
3	Unit III : Multivibrators and Flip Flops: Construction & working of Astable, monostable and Bistable transistorised multivibrators, RS, CK-RS, D, JK, JKMS and T Flip Flops (Logic diagram, Truth table, construction & working), Concept of edge trigger Flip-Flop, Concept of preset & clear terminal.	At the end of this unit, students will be able to know construction and working of multivibrators and flip-flops. Also they will be able to design and construct different types of flip-flops using logic gates.
4	Unit IV : Counters and Shift registers: Asynchronous & synchronous Counter, Up-down counters (up to 4-bits), modified asynchronous counter (Mod -7 ,Mod- 10,and Mod-13).Types of shift registers, SISO, SIPO, PISO & PIPO, IC version of Mod -10 shift registers (Construction & working), IC version of shift register – 7495, Application of shift register. Ring counter, Johnson's counter.	At the end of this unit, students will be understand the construction and working of different types of counters and shift registers and their IC version. They will be able to design and construct different types of counters and shift registers using flip-flops and logic gates.
5	Unit V : Combinational logic circuit: Encoder: Binary to BCD, Decimal to BCD, IC 74147, Decoder: 2 to 4 line, BCD to decimal, BCD to 7 segment, IC 7447, Multiplexer: 4X1, 8X1, De multiplexer: 1X4, 1X8, (Definition, construction, operation and application of above) concept of Embedded systems.	After this unit, students will be know the construction and working of different types of encoders, decoders, multiplexers and demultiplexers and their IC version. They will be able to design and construct different types of encoders, decoders, multiplexers and demultiplexers using logic gates.
6	Unit VI : Semiconductor Memories:	At the end of this unit, students will be able

	Concept of memory, primary and secondary memory, classification of memories, volatile and non-volatile memories, memory Hierarchy, semiconductor memory: RAM, ROM, PROM, EPROM, EEPROM, flash memory.	to know different types of memories and their working. They will be able to access these memories in serial and parallel mode (to read and write operations).
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Books Recommended:

1. Digital and analog technique by Navneet, Kale and Gokhale (Kitab mahal prakashan)
2. Introduction to digital electronics by Mohinder Singh
3. Digital principle and application by Malvino and Leach
4. Modern digital electronics by R. P. Jain
5. Pulse, digital and switching waveforms by Millman and Taub

Practicals: Minimum Ten experiments at least one on each of the following aspects.

1. Half adder, full adder, code converter, Identification and verification of logic gates, 4-bit binary full adder(IC versions)
2. De'Morgan's theorems, K-map, TTL and CMOS logic, knowing characteristics of logic families.
3. Transistorized Astable, Bistable and monostable multivibrator, JK and JKMS flipflops, Data Flipflop, RS, CK RS Flipflop.
4. 4-bit binary counter, modifying counter, ring and Johnson's Counters (Using ICs), SISO, SIPO, PISO and PIPO.
5. Decoder, multiplexer, IC74147 mounting and testing.
6. Study of memories.

General Interest Course (GIC-1)
(Level: B.Sc. I)

Calibration and Equipment Maintenance Techniques

Total Hours: 30**Credits: 02**

Description: This GIC is about the medical Equipment Technician to calibrate and help in equipment maintenance.

Scope: This units covers the following:

- Calibrating and helping in equipment maintenance.

Performance Criterion:

To be competent, the user/ individual on the job must be able to:

- Test and calibrate parts and equipment
- Calibrated equipment according to the manufacturer's recommendations, study protocols.
- Maintain calibration record for the equipment.
- Maintain the calibration sheet for inspection by the regulatory authorities and other relevant authorities.
- Help in equipment maintenance.
- Keep records of maintenance and repairs.

Knowledge and Understanding:

The user/ individual on the job needs to know and understand:

- Relevant legislation, standards, policies and procedures followed by the provider.
- How to follow established protocols as defined in organization's policy while keeping and maintaining medical records.

Technical Knowledge

The user/ individual on the job must be able to:

- Test the equipment.
- Calibrate the equipment.
- Record calibration on relevant sheet.
- Review technical manuals and regularly attend training sessions.
- Explain and demonstrate correct operations of medical equipment.

Core Skills/ Generic Skills:

Writing Skills:

The user/individual on the job needs to know and understand how to:

- Use effective written communication protocols.
- Communicate information (for example, facts, ideas or messages) in brief, clear and organized manner.
- Produce written information, which may include technical material, that is appropriate for intended audience.

Reading Skills:

The user/ individual on the job needs to:

- Understand and interpret written material, including technical materials, rules, regulations, instructions, reports, charts, graphs or tables.

Problem Solving:

The user/ individual on the job needs to:

- Detect the fault and take corrective measures.

Analytical Thinking:

The user/ individual on the job needs to know and understand how to:

- Analyze information and use logic to address work-related issues and problems.

Critical Thinking:

The user/ individual on the job needs to know and understand how to:

- Analyze, evaluate and apply the information gathered from observation, experience, reasoning or communication to act efficiently.
- Demonstrate the ability to adapt to rapidly changing situations, e.g.: responds appropriately to critical situations, retains composure in stressful situations, applies existing skills to new situations.

SANT GADGE BABA AMRAVATI UNIVERSITY

B.Sc. Part-I, Semester – I

Programme – UG

Name of Course – Marathi Compulsory

Sub Code : 1011

Total Lectures : 3 (Per Week)

प्रस्तावना

विद्यापीठ अनुदान आयोगाची मार्गदर्शक तत्वे आणि बदलत्या काळाचे आव्हाने ध्यानात घेऊन बी.एस.सी. भाग १ मराठी (अनिवार्य) या वर्गासाठी अभ्यासमंडळाने संपादित केलेले ‘ऋतुरंग’ हे पाठ्यपुस्तक आपल्या स्वाधीन करतांना आनंद होतो आहे.

अध्ययन - अध्यापन प्रक्रियेचा केंद्रबिंदु असलेला विद्यार्थी, त्यांच्या सर्वांगीण विकास साधण्याच्या दृष्टीने, विद्यार्थ्यांची ज्ञानार्जन क्षमता आणि मूल्यमापन प्रक्रिया या दोहोची सांगड घालण्याचा प्रयत्न या पाठ्यपुस्तकात केला आहे.

Course Outcome (प्रमुख साध्य)

भाषेच्या आकलनाबरोबरच विद्यार्थ्यांमध्ये समाजातील उच्चकोटीची मानवी मूल्ये वृद्धीगत व्हावी, राष्ट्रीय एकात्मता, सामाजिक बांधिलकी, मानुषता, राष्ट्रप्रेम, राष्ट्रभक्ती, वैज्ञानिक दृष्टिकोन, पर्यावरण संरक्षण - संवर्धन, भूतदया इत्यादीची पेरणी व्हावी, विद्यार्थ्यांची मातृभाषा आणि वाङ्मयविषयक अभिरुची वाढीला लागावी, त्यांना दर्जेदार व व्यवसायभिमुख शिक्षण मिळावे याकरिता केंद्र सरकारच्या मानव संसाधन आयोगाने जी ध्येय धोरणे निश्चित केली आहेत त्या अनुषंगाने हा अभ्यासक्रम, नवीन शैक्षणिक धोरणाच्या परिप्रेक्ष्यात, निश्चित करण्याचे धोरण संत गाडगे बाबा अमरावती विद्यापीठाने अत्यंत विचारपूर्वक स्वीकारलेले आहे.

Course Specific Outcome (प्रामुख्याने साध्य)

मराठी भाषा हा केवळ शिकण्याचा आणि शिकविण्याचाच विषय नाही तर ते आत्मप्रकटीकरणाचे एक प्रभावी माध्यम आहे. तसा व्यक्तिमत्त्व घडविणारा तो संस्कारही आहे. बहुविध अंगाने तो व्हायला हवा. त्याबरोबरच भाषेच्या सर्वांगीण अभ्यासाची दिशा विद्यार्थ्यांना सूचित व्हावी, साहित्यसरितेतील विविध वाङ्मय प्रकाराची आणि प्रवाहाची ओळख व्हावी हा उद्देश प्रामुख्याने ठेवला आहे.

Employability Potential of the Course (रोजगार निर्मिती क्षमता)

विद्यार्थ्यांच्या भविष्याच्या संदर्भात सकारात्मक विचार करून अभ्यासक्रम तयार करण्यात आला आहे. परिक्षेतील विविध प्रश्न व त्यांच्या परिणामाची तसेच मराठी साहित्याचा उगम आणि वाटचालीची जाण व्हावी यादृष्टीने प्राचीन - मध्ययुगीन आणि अर्वाचीन साहित्यातील निवडक वेचे या पाठ्यपुस्तकात समाविष्ट केले असून कथा, कविता, वैचारिक लेख, आत्मचरित्र, निबंध इत्यादी वाङ्मयप्रकारातील प्रातिनिधिक उतारे व दर्जेदार कविता निवडण्याचा प्रयत्न केला आहे.

विद्यार्थ्यांचा फायदा

या अभ्यासक्रमामागची महत्वपूर्ण भूमिका म्हणजे विद्यार्थ्यांचे सशक्त भविष्य तसेच त्यांची आयुष्याकडे बघण्याची सकारात्मक भूमिका निर्माण व्हावी आणि विद्यार्थ्यांना त्यांचे ध्येय प्राप्त करता येऊन नोकरी, व्यवसाय यामध्ये तो भक्कमपणे उभा राहून आपल्या विकासाबरोबर समाजाचाही विकास होऊन त्याचाही फायदा व्हावा. त्याचबरोबर या अभ्यासक्रमातून त्यांच्यात सकारात्मकता निर्माण व्हावी, हाही उद्देश आहे.

कौशल्य संवर्धन मॉड्युल (Skill Enhancement Module)

विद्यार्थ्यांनी प्रसिद्ध साहित्यिकांची प्रत्यक्ष मुलाखत घेऊन साहित्य निर्मितीच्या प्रेरणा जाणून घेणे. व त्याद्वारे साहित्यिकांच्या साहित्याचे विश्लेषण करणे. यावर आधारीत प्रकल्प तयार करून मुलाखत देणे.

बी.एस.सी. (भाग१)

विषय - मराठी अनिवार्य

सत्र १ ले

गद्य

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| १. पाखाला बाळास पांगुरवाणे | - म्हाइंभट |
| २. गाडगे बाबांनी शाळा दिली | - सीमा साखरे |
| ३. ... आणि गहुली झाली माऊली | - प्रकाश राठोड |
| ४. रद्दी | - विलास अंभोरे |
| ५. नियतीच्या विक्राळ जबड्यात ! | - सिंधुताई सपकाळ |
| ६. अन्वरशा फकीर | - मधुकर वाकोडे |

पद्य

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| १. संतवाणी | अ - संत ज्ञानेश्वरांचे अभंग | - घनु वाजे घुणघुणा |
| | ब - संत तुकारामाचे अभंग | - टिळा टोपी उंच दावी |
| २. विद्यार्थ्याप्रत | | - केशवसुत |
| ३. सुख | | - बबन सराडकर |
| ४. विश्वशांती | | - दिनेश काळे |
| ५. बाप | | - प्रमोद गारोडे |

व्यावहारिक मराठी

१. व्यावहारिक मराठी - स्वरूप आणि भूमिका
२. भाषिक संवाद व्यवहारांची मूलतत्वे

बी.एस.सी. (भाग१)

विषय - मराठी अनिवार्य

सत्र २ रे

गद्य

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| १. शिक्षण | — जोतीराव फुले |
| २. डॉ. पंजाबराव देशमुख | — वि.भि. कोलते |
| ३. भारतीय संविधानाची विज्ञाननिष्ठा | — यशवंत मनोहर |
| ४. कृष्णविवर | — जयंत नारळीकर |
| ५. लापड | - गणेश चव्हाण |
| ६. ग्रामगीतेतील अस्पृश्यता निर्मूलन विचार | - सिंधू मांडवकर |

पद्य

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| १. संतवाणी | अ - संत मुक्ताबाई | - मुंगी उडाली आकाशी |
| | ब - संत रामदास | — निश्चयाचा महामेरु |
| २. आजोबा | | — विनायक पवार |
| ३. मलाला युसुफझाई | | — विष्णू सोळंके |
| ४. हुंकार | | — अनिल काळबांडे |
| ५. विज्ञानयुग | | - आ.य.पवार |

व्यावहारिक मराठी

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| १. मराठी भाषा आणि प्रसारमाध्यमे | - डॉ.सर्जनादित्य मनोहर |
| २. जाहिरातीची लेखन कौशल्ये | - प्रा. वैशाली कार्लेकर |

अभ्यासक्रम व गुण विभागणी

गद्य	— एकूण गुण १५
पद्य	— एकूण गुण १५
व्यावहारिक मराठी	— एकूण गुण १०

कौशल्य संवर्धन मॉड्युल (Skill Enhancement Module)

— व्यावहारिक मराठीच्या अभ्यासक्रमावर प्रकल्प तयार करणे व त्यावर प्रत्यक्ष मुलाखत	— एकूण गुण १०
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गद्य व पद्य विभाग

प्रश्न १ ला : वस्तुनिष्ठ बहुपर्यायी प्रश्न (गद्य गुण ५ अ पद्य गुण ५) सर्व प्रश्नांना समान गुण	— एकूण गुण १०
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गद्य विभाग

प्रश्न २ रा : लघुत्तरीप्रश्न — कोणतेही दोन प्रश्न सोडवा १०	— एकूण गुण
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पद्य विभाग

प्रश्न ३ रा : लघुत्तरीप्रश्न — कोणतेही दोन प्रश्न सोडवा १०	— एकूण गुण
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व्यावहारिक मराठी

प्रश्न ४ था : कोणतेही दोन प्रश्न सोडवा १०	— एकूण गुण
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व्याखानांचे वितरण (Distribution of Lectures)

Unit	No of Lectures
१) गद्य	१६
२) पद्य	१४
३) व्यावहारिक मराठी (Skill Enhancement Module) -	१०
४) कौशल्य संवर्धन मॉड्युल (Skill Enhancement Module) -	10

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty: Science & Technology

Programme:- B.Sc.

Subject: Compulsory English

Preamble:

English language plays an essential role in our lives as it helps in better communication on personal, social, literary, interdisciplinary topics and also in business world. It is the main language for studying any subject all over the world. It shall help to build up general language proficiency through listening, speaking, reading and writing, and provide the more opportunity to acquire broader information and specialized knowledge of particular subject through the English language. It is important for science students to learn English as it broadens their minds, develops communication skills and improves the quality of life by providing better job opportunities. It will perfect their communicative credentials, gain confidence, lead to achieve the goal early, make their personality effective, make them the part of global community, and enhance the opportunity of multiple career prospects. Since English is a global language used in many spheres of human life today, it has gained significance in every field. Skills and expertise acquired in usage of the language makes the students present themselves effectively and skilfully for jobs/ employment/ profession in various fields.

Course Outcome :

1. To facilitate the learners in acquiring listening and speaking competence
2. To assist the learners in independent language comprehension and production
3. To make the students aware about the different communicative functions of English.
4. To improve skills and proficiency for being employed as teachers, state government employees, civil aviation, engineering and medico-related industry, defence, commerce and taxation sector.
5. To be able to speak, write, read and listen flawlessly in person and through the electronic mode in English.
6. To understand views of others, mediate contradictory views/ disagreements, reaching conclusion in groups / group discussions.
7. To understand and use basic skills of the English language for applying it in the job assigned / employment accepted / profession undertaken.

Course Specific Outcome :

After completion of this course successfully, students would be able to

1. Understand nature and nuances of English Language used in prose lessons and poetic passages.
2. Apply the knowledge of English to communicate with others on personal, social, literary and interdisciplinary topics.
3. Compare the structure of English language to use LSRW.
4. Formulate the sentences as per situational requirement.
5. Differentiate between acceptable and unacceptable sentences in English.

6. Create appropriate, grammatically correct and acceptable sentences in English.
7. Develop general language proficiency through listening, speaking, reading and writing

Employability Potential of the Course:

English being one of the subjects only for Semester one and two in B.Sc degree restrict the students to learn English further in subsequent semesters. It is found that Compulsory English subject is given less importance and consequently the students of rural area are mostly affected and poor in their communications of English. However students who pass the B.Sc programme with English as one of the subjects in Semester one and Semester two have good opportunities of employment in education, private, semi-government, government, and industry sectors. The pass outs could get a job as per the core subject offered by them. If they develop their skills of communications, they can get the good job in their respective field. English is important for students as it broadens their minds, develops communication skills, employability skills and improves the quality of life by providing job opportunities.

English is the language of technology, agriculture, medical, aviation, computers, diplomacy, business and tourism. It is the language of international communication, the media and the internet. Whether it is for professional or personal reasons, understanding the importance of English will help the students to reach their goals. Knowing English increases the chances of getting a good job in a national and multinational company within the home country or of finding work abroad. In addition, English is increasingly used day by day in education and as a working language in many reputed companies. English is used in films, literature, songs, sports, trade, products, science and technology, and through these areas many English words and expressions have found their way into our mother tongue also. First and foremost, studying English can help the students to pursue and obtain more job opportunities. No matter what career pathway the students decide for them proficiency in English facilitates to become a better and more sought after employee.

Syllabus Prescribed for B.Sc. I Sem I Year UG Programme

Programme: B.Sc

Semester 1

Course Learning Outcome /CO

At the end of the Course, student would be able to:

CO1 understand the paragraph, prose, poetry and communicative skills.

CO2. apply the four skills of language in his daily inter-personal communications.

CO3. formulate/ compose his own sentences and able to speak English Language.

CO4. converse with other students in English.

CO5. communicate their ideas, thoughts and concepts properly in English.

B. Sc. I Semester I Compulsory English

Course Title	English
Course Code	
Course Category:	
Type of Course:	Theory + Practical
No. of Credits:	Theory - 04 + Tutorial – 01(Each batch of 16 students)
No. of Lectures:	Theory - 60 + Tutorial -15
Course Assessment:	End Term: 40 Marks (University level exam) SEM (Internal): 10 Marks (College level evaluation) AEC (Internal) : 25 Marks (College level evaluation)
Course Objective:	To train and prepare the students to seek and find employment in various field. To develop communicative competence in students To impart knowledge, ideas and concepts in the technicalities of proper pronunciation, construction, appropriate use and style of the English language as well as the application in the areas of English Communication Skills. To expose the students to the employment opportunities, challenges and job roles.
Course Outcomes:	At end of the course students would be able to CO1 understand the paragraph, prose, poetry and communication skills CO2. apply the four skills of language in his daily routine. CO3. formulate/ compose his own sentences and able to speak English Language.

	CO4. collaborate with others students in English.
	CO5. communicate properly their ideas and concepts in English.

**B.Sc. Part I Semester – I
Compulsory English**

**Text Book Prescribed : *Magnificence* Edited by Board of Editors, Sant Gadge Baba Amravati University,
Amravati**

Publisher : Orient BlackSwan Pvt Ltd

Code :	Lectures
Unit I : Prose	18
1) Appro JRD – Sudha Murthy 2) All about a Dog – A. G. Gardiner 3) The Power of Prayer – APJ Abdul Kalam 4) Model Millionaire – Oscar Wilde	
Unit II : Poetry	18
1) Daffodils – William Wordsworth 2) Leisure – W. H. Davies 3) Stay Calm – Grenville Kleiser 4) The Mountain and the Squirrel - Ralph W. Emerson	
Unit III : Writing Skills	12
1) Preparing a CV 2) Applying for a Job 3) Narrating an Experience 4) Creative Writing (Expansion of idea)	
Unit IV: Communication Skills	
1. Non –Verbal Communication 2. Preparing a Newspaper Report	12
Unit V: Skill Enhancement Module (SEM)	15
1) Spot Visit and preparing a report – Visit to Super Market, Bus Stand, Railway Station, Bank, Medical Shop, Bakery etc. 2) Interview of a dignitary and writing a report in dialogue form (Skill Enhancement module will be of 25 marks. This module will be internally assessed flexibly on the basis of Class tests, assignments, seminar, reading material, project, survey, group discussion, Study tour, MCQ, Open Book exam (OBE), etc.)	
Internal Assessment:	
1) Class Test	5 Marks
2) Viva-Voce	5 Marks

(For Skill Enhancement Module and internal assessment the subject teacher shall be the sole examiner.)

Pattern of Question paper and Distribution of Marks
Maximum Marks: 40 **Time: Two Hours**

- Que. 1 A : Students shall have to answer 4 MCQ questions based on Prose of one mark each. $4 \times 1 = 4$
 Que. 1 B. Students shall have to answer 2 long answer questions based on Prose out of four questions.
 Each question carries four marks each. $4 \times 2 = 8$
 Que.2 A: Students shall have to answer 4 MCQ questions based on Poetry of one mark each. $4 \times 1 = 4$
 Que.2 B. Students shall have to answer 2 long answer questions based on Poetry out of four questions.
 Each question carries four marks each. $4 \times 2 = 8$
 Que. 3. Students shall have to answer two questions based on unit three, out of four questions from this Unit. $4 \times 2 = 8$
 Que. 4. Students shall have to answer two questions based on unit four, out of four questions from this Unit. $4 \times 2 = 8$

B. Sc. I Semester II Compulsory English

Course Title	English
Course Code	
Course Category:	
Type of Course:	Theory + Practical
No. of Credits:	Theory - 04 + Tutorial – 01 (Each batch of 16 students)
No. of Lectures:	Theory - 60 + Tutorial -15
Course Assessment:	End Term: 40 Marks (University level exam) SEM (Internal): 10 Marks (College level evaluation) AEC (Internal) : 25 Marks (College level evaluation)
Course Objective:	To train and prepare the students to seek and find employment in various field. To develop communicative competence in students To impart knowledge, ideas and concepts in the technicalities of proper pronunciation, structure, appropriate use and style of the English language as well as the application areas of English Communication. To expose the students to the employment opportunities, challenges and job roles.
Course Outcomes:	➤ At end of the course students would be able to CO1 understand the paragraph, prose, poetry and communication skills CO2. apply the four skills of language in his daily routine. CO3. formulate/ compose his own sentences and able to speak English Language. CO4. collaborate with others students in English. CO5. communicate properly their ideas, thoughts and concepts in English.

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Semester II Compulsory English

Text Book Prescribed : *Magnificence* Edited by Board of Editors, Sant Gadge Baba Amravati University, Amravati

Publisher : Orient BlackSwan Pvt Ltd

Code :	Lectures
Unit I : Prose	18
1) The Last Leaf – O’ Henry	
2) Of Studies – Francis Bacon	
3) Why is the Sea Blue? – G. Venkatraman	
4) The Mute Companion - R. K. Narayan	
Unit II : Poetry	18
1) Treasured Moments – Manjushree Sardeshpande	
2) Ode on a Grecian Urn – John Keats	
3) Leave this Chanting and Singing – Ravindranath Tagore	
4) How do I love thee? – Elizabeth Barrett Browning	
Unit III : Speaking Skills	12
1) Introducing Yourself	
2) Introducing People to Others	
3) Interviews	
4) Describing Daily Routine	
Unit IV: Communication Skills	12
1) Verbal Communication	
2) Précis Writing	
Unit V: Skill Enhancement Module	15
1) Blog Writing	
2) Presentation on a topic from prescribed prose/poem	
(Skill Enhancement module will be of 25 marks. This module will be internally assessed flexibly on the basis of Class tests, assignments, seminar, reading material, project, survey, group discussion, Study tour, MCQ, Open Book exam (OBE), etc.)	
Internal Assessment:	
1) Class Test	5 Marks
2) Viva-Voce	5 Marks

(For Skill Enhancement Module and internal assessment the subject teacher shall be the sole examiner.)

Pattern of Question paper and Distribution of Marks**Maximum Marks: 40****Time: Two Hours**

Que. 1 A : Students shall have to answer 4 MCQ questions based on Prose of one mark each. $4 \times 1 = 4$

Que. 1 B : Students shall have to answer 2 long answer questions based on Prose out of four questions. Each question carries four marks each. $4 \times 2 = 8$

Que.2 A: Students shall have to answer 4 MCQ questions based on Poetry of one mark each. $4 \times 1 = 4$

Que.2 B: Students shall have to answer 2 long answer questions based on Poetry out of four questions. Each question carries four marks each. $4 \times 2 = 8$

Que. 3. Students shall have to answer two questions based on unit three, out of four questions from this Unit. $4 \times 2 = 8$

Que. 4. Students shall have to answer two questions based on unit four, out of four questions from this Unit. $4 \times 2 = 8$

Faculty: Science & Technology
Programme:-B.Sc.

Syllabus for B.Sc. Part-I
Subject: Compulsory English

Preamble:

Since English is a global language used in many spheres of human life, it has gained significance. Skills and expertise acquired in usage of the language makes the person present himself / herself for jobs/ employment/ profession in various fields.

After studying the programme the learner shall be able to understand basic skills of the English language for applying it in his / her chosen field to apply the knowledge acquired in the job assigned / employment accepted / profession undertaken.

General Course Outcome (COs) :

1. To facilitate the learners in acquiring listening and speaking competence
2. To assist the learners in independent language comprehension and production
3. To make the students aware of the different communicative functions of English.
4. To impart skills and proficiency for being employed as teachers, state government employees, civil aviation, engineering and medico-related industry, defence, commerce and taxation sector.
5. To be able to speak, write, read and listen flawlessly in person and through the electronic mode in English.
6. To understand views of others, mediate contradictory views/ disagreements, reaching conclusion in groups / group discussions.

Course Specific Outcome :

After completion of this course successfully, students would be able to

1. Understand nature and nuances of English Language used in prose lessons, poetic passages.

Course Learning Outcome

At the end of the Course, student would be able to:

1. Understand the paragraph, prose and poetry.
2. Apply the four skills of language in his daily inter-personal communications.
3. Formulate/ compose his own sentences and able to speak English Language.
4. Converse with other students in English.
5. Communicate their ideas and concepts properly in English.

Employability Potential:

Students who pass the B.Sc programme with English as one of the subjects in Semester one and two have good opportunities of employment in Education, industry, sectors pass outs could get a job as steno, receptionist, event manager etc. If he / She develops his/ her can play the role or a job as a translator.

Students, who learn English language and grammar are good at communicating effectively, write and speak in English. This makes them eligible to grab career opportunities, such as translator, professor, various posts in media, industry, ministry etc.

Examinations leading to the Degree of Bachelor of Science
(Three Years Six Semesters Degree Programme) (Choice Based Credit System)
Scheme of Teaching, Learning, Examination and Evaluation (B.Sc. Part-I) (Mathematics) (Semester-I)

APPENDIX - AI

Sr. No	Subject	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits				Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory/ Tutorial	Practical	Total		Theory + M.C.Q Ext.	Skill Enhancement Module (SEM) Int.	Practical		Total Marks	Marks	Grade
1	Compulsory English		4	-		4	3	-	3	3	40	10	-	-	50	20	P
2	Communication Skill in English (AEC)		-	1	-	1	0.75	-	0.75	1			25	-	25	10	P
3	Second Language		2	-	-	2	1.5	-	1.5	3	40	10	-	-	50	20	P
4	Communication Skill in Second Language (AEC)		1	-	-	1	0.75	-	0.75	1			25	-	25	10	P

B. Sc. I Semester I Compulsory English

Course Title	English
Course Code	
Course Category:	
Type of Course:	Theory + Practical
No. of Credits:	Theory - 04 + Tutorial – 01 (Each batch of 16 students)
No. of Lectures:	Theory - 60 + Tutorial -15
Course Assessment:	End Term: 40 Marks (University level exam) SEM (Internal): 10 Marks (College level evaluation) AEC (Internal) : 25 Marks (College level evaluation)
Course Objective:	To train and prepare the students to seek and find employment in various field. To develop communicative competence in students To impart knowledge, ideas and concepts in the technicalities of proper pronunciation, structure, appropriate use and style of the English language as well as the application areas of English Communication. To expose the students to the employment opportunities, challenges and job roles.
Course Outcomes:	At end of the course students would be able to

	At the end of the Course, student would be able to: CO1 Understand the paragraph, prose, poetry CO2. Apply the four skills of language in his daily routine. CO3. Formulate/ compose his own sentences and able to speak English Language. CO4. Collaborate with others students in English. CO5. Communicate properly their ideas and concepts in English.
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**B.Sc. Part I
Compulsory English
Semester – I**

Code : Lectures

Unit I : Prose 18

- 1) Appro JRD – Sudha Murthy
- 2) All about a Dog – A.G.Gardiner
- 3) The Power of Prayer – APJ Abdul Kalam
- 4) Model Millionaire – Oscar Wilde

Unit II : Poetry 18

- 1) Daffodils – William Wordsworth
- 2) Night of the Scorpion – Nissim Ezekiel
- 3) Stay Calm – Grenville Kleiser
- 4) The Mountain and the Squirrel - Ralph W. Emerson

Unit III : Writing Skills 12

- 1) Preparing a CV
- 2) Applying for a Job
- 3) Narrating an Experience
- 4) Creative Writing (Expansion of idea)

Unit IV: Communication Skills

1. Non –Verbal Communication 12
2. Preparing a Newspaper Report

Unit V: Skill Enhancement Module 15

- 1) Spot Visit and preparing a report – Visit to Super Market, Bus Stand, Railway Station, Bank, Medical Shop, Bakery etc.
- 2) Interview of a dignitary and writing a report in dialogue form

(Skill Enhancement module will be of 25 marks. It will be evaluated at college level)

Internal Assessment:

- | | |
|---------------|---------|
| 1) Class Test | 5 Marks |
| 2) Viva-Voce | 5 Marks |

(For internal assessment the subject teacher shall be the sole examiner.)

B. Sc. I Semester II Compulsory English

Course Title	English
Course Code	
Course Category:	
Type of Course:	Theory + Practical
No. of Credits:	Theory - 04 + Tutorial – 01(Each batch of 16 students)
No. of Lectures:	Theory - 60 + Tutorial -15
Course Assessment:	End Term: 40 Marks (University level exam) SEM (Internal): 10 Marks (College level evaluation) AEC (Internal) : 25 Marks (College level evaluation)
Course Objective:	To train and prepare the students to seek and find employment in various field. To develop communicative competence in students To impart knowledge, ideas and concepts in the technicalities of proper pronunciation, structure, appropriate use and style of the English language as well as the application areas of English Communication. To expose the students to the employment opportunities, challenges and job roles.
Course Outcomes:	➤ At end of the course students would be able to At the end of the Course, student would be able to: CO1 Understand the paragraph, prose, poetry CO2. Apply the four skills of language in his daily routine. CO3. Formulate/ compose his own sentences and able to speak English Language. CO4. Collaborate with others students in English. CO5. Communicate properly their ideas and concepts in English.

Semester II Compulsory English

Code :	Lectures
Unit I : Prose	18
1) The Last Leaf – O’ Henry	
2) Of Studies – Francis Bacon	
3) Why is the Sea Blue? – G. Venkatraman	
4) The Mute Companion - R.K. Narayan	
Unit II : Poetry	18
1) Once Upon a Time – Gabriel Okara	
2) Ode on A Grecian Urn – John Keats	
3) Leave this Chanting and Singing – Ravindranath Tagore	
4) How do I love thee? – Elizabeth Barrett Browning	
Unit III : Speaking Skills	12
1) Introducing Yourself	
2) Introducing People to Others	
3) Interviews	
4) Describing Daily Routine	
Unit IV: Communication Skills	12
1) Verbal Communication	
2) Précis Writing	
Unit V: Skill Enhancement Module	15
1) Blog Writing	
2) Presentation on a topic from prescribed prose/poem	
(Skill Enhancement module will be of 25 marks. It will be evaluated at college level)	
Internal Assessment:	
1) Class Test	5 Marks
2) Viva-Voce	5 Marks
(For internal assessment the subject teacher shall be the sole examiner.)	

Pattern of Question paper and Distribution of Marks

Maximum Marks: 40

Time: Two Hours

Que. 1. A Students shall have to answer 4 MCQ questions based on prose of one mark each. 4x1=4

B. Students shall have to answer 2 long answer questions based on prose out of four questions. Each question carries four marks each. $4 \times 2 = 8$

Que.2 A. Students shall have to answer 4 MCQ questions based on poetry of one mark each. $4 \times 1 = 4$

B. Students shall have to answer 2 long answer questions based on poetry out of four questions. Each question carries four marks each. $4 \times 2 = 8$

Que. 3. Students shall have to answer two questions based on unit three out of four questions with intra-Unit choice. $4 \times 2 = 8$

Que. 4. Students shall have to answer two questions based on unit four out of four questions with intra-Unit choice. $4 \times 2 = 8$

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B.Sc. (Mathematics)

POs:

At the end of the programme, graduates would be able to

1. Enhance the knowledge of student in all basic sciences.
2. Identify ,formulate and develop solutions to computational challenges.
3. Develop scientific temper and think in a critical manner.
4. Build up progressive and successful career in academics, industry and society.
5. Develop students abilities and aptitudes to apply the mathematical ideas.

PSOs :

Upon completion of the programme successfully, students would be able to

1. Understand major concepts in all disciplines of Mathematics
2. Formulate and develop Mathematical arguments in a logical manner
3. Gain good knowledge and understanding in advanced Mathematics
4. Create an awareness of the impact of Mathematics on the environment, society and development outside the scientific community.
5. Create sensitivity towards environmental concerns and contribute in the development of nation

Employability Potential of the Programme:

Career options for B.Sc. Mathematics students is not just limited to solving complex equation. Apart from the traditional career route of academics and research, there are many career options offer for B.Sc. Mathematics students that can pick up banking, corporate, accounting and even teaching as their career option on completion of B.Sc. Mathematics, even a career in medicine and law is possible for Mathematics Honors student. Also, a degree with Mathematics is even financially supporting for students because they help in landing placement opportunities by giving an edge over students with B.Sc. physics or other major.

After completing B.Sc. Mathematics, a student can either decide to go for higher studies or apply for jobs. In the case of B.Sc. Mathematics Honors, both the options are very promising. After the B.Sc. Mathematics course, students can pursue M.Sc. Mathematics and follow it up with an M. Phil or Ph.D. Students can become a mathematician doing research and also become a assistant professor. Also students can pursue a B. Ed. and become a school teacher. Moreover, student can work in related field which required mathematical skills (Machine learning, Data Science etc.). Thus, there exist innumerable B.Sc. Mathematics career options.

The best way to get a prestigious government job is through competitive exams. Exams like UPSC, Railways, and Commission etc. are some important competitive exams that one need to consider as portals for B.Sc. Mathematics career options.

Syllabus Prescribed for the year 2022-23, UG Programme

Programme : B.Sc.-I (Mathematics)

Semester- I

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC-I / Mathematics	Algebra and Trigonometry	9+1

Cos: After completing this course, students would be able to

- 1. find inverse and normal form of matrices .
- 2. evaluate the characteristic equation, eigen value and corresponding eigen vector of a given matrix
- 3. evaluate relation between the roots and coefficients of equations .
- 4. to study application of De Moivre’s theorem .
- 5. compute summation of trigonometric series.

Unit	Content
Unit I	Various types of matrices, Square matrix, triangular matrix, Hermitian and skew-Hermitian matrix, orthogonal matrices, singular and non- singular matrices, adjoint and inverse of matrix. Elementary transformation of a matrix, inverse of elementary transformation of a matrix , normal form of a matrix. (12 period)
Unit II	Rank of a matrix, row rank, column rank, eigen values, eigen vectors and the characteristic equation of a matrix, Cayley-Hamilton theorem, inverse by Cayley-Hamilton theorem. (12 period)
Unit III	Theory of equations: Descarte's rule of signs, relations between the roots and coefficients, transformation of equations, cubic equations. (12 period)
Unit IV	De Moivre’s theorem, roots of complex number, circular functions, hyperbolic function, inverse hyperbolic function, relation between circular functions and hyperbolic functions, separation of real and imaginary parts of circular and hyperbolic functions of complex variable. (12 period)
Unit V	Summation of trigonometric series, Gregory series, Euler’s series, Machin’s series, Rutherford’s series, series based on $\sin x$, $\cos x$, $\sinh x$, $\cosh x$ and exponential series. (13 period)
*SEM	
COs: 1.To enhance interest among the students about course. 2. To develop the learning and writing skills. 3. To create mental ability.	
**Activities	1. Unit Test 2. Assignment/ open book test 3. Quiz/ Study Tour

Text books :

1] T. M. Karade, Maya S.Bendre, V. G. Mete, R. S. Wadbudhe, S. N. Bayaskar, P. P.Khade: Elements of Algebra and Trigonometry. Sonu-Nilu , Nagpur, 2022.

2] V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari: A Text book of Algebra and Trigonometry, Dnyanpath Publication, Amravati, First Edition, 2022.

Reference Books:

1] K.B.Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd. New Delhi, 2000.

2] H.S.Hall and S.R.Knight, Higher Algebra, H.M.Publications, 1994.

3] S.L.Loney, Plane Trigonometry Part-II, MacMillan & Co., London.

4] Ayres Jr Frank : Matrices : Schaum's outline series, McGraw Hill Book Company, Singapore, 1983.
5] Hohn Franz E : Elementary Matrix Algebra, Amerind Publishing Co., Pvt.Ltd. 1964.
6] Shanti Narayan : A Test Book of Matrices, S.Chand & Co. Delhi.

Programme: B.Sc.-I (Semester-I), Mathematics

Syllabus Prescribed for the Year 2022-23 , UG Programme

**Programme : B.Sc.-I
Semester- I**

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC-II / Mathematics	Differential and Integral Calculus	9+1

Cos: After completing this course, students would be able to

1. define limit and study the basic properties .
2. classify continuity and discontinuity of the functions.
3. solve the differentiability and L’Hospital rule with their applications.
4. describe the geometrical applications of mean value theorems.
5. evaluate the reduction formulae for integration.

Unit	Content
Unit I	Limit of a function, ϵ - δ definition, basic properties of limits, some standard limits. (12 period)
Unit II	Continuous and discontinuous functions, types of discontinuity, properties of continuous functions, uniform continuous functions, properties of uniform continuous functions. (12 period)
Unit III	Differentiability, successive differentiation, Leibnitz theorem, indeterminate forms and L’ Hospital rule. (12 period)
Unit IV	Rolle’s theorem, Lagrange’s mean value theorem, Cauchy’s mean value theorem, Maclaurin’s and Taylor’s series expansions. (12 period)
Unit V	Integration of the form $\int \frac{P_n(x)}{\sqrt{Q}} dx$, reduction formulae for $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int \cot^n x dx$, $\int \sec^n x dx$, $\int \operatorname{cosec}^n x dx$, $\int \sin^n x . \cos^m x dx$ and Walli’s formula. (13 period)

*SEM	
COs: 1.To enhance interest among the students about course. 2.To develop the learning and writing skills. 3.To create mental ability.	
**Activities	1. Unit Test 2. Assignment/ open book test 3. Quiz/ Study Tour

Text books :

1] T.M. Karade , Maya S. Bendre, V. P. Kadam, A.S.Nimkar,K.S.Wankhade,C.D.Wadale:
Elements of Calculus (Differential and Integral), Sonu- Nilu, Nagpur, 2022.

2] V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari: A Text book of Differential and
Integral Calculus: Dnyanpath Publication, Amravati, First Edition, 2022.

Reference Books :

1] Ayres F Jr. : Differential equations, Schaum's outline series, McGraw Hill, 1981.

2] Ayres F.Jr. : Calculus, Schaum's Outline series, McGRaw Hill, 1981.

3] Edwards J : Differential Calculus for Beginners, MacMillan and Co.Ltd.,1963.

4] Greenspan D. : Introduction to Calculus, Harper and Row, 1968.

5] Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad, 1963

6] Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad,1981

7] N.Piskunov : Differential and Integral Calculus, Peace Publishers, Moscow.

8] B. Choudhary and D. Somasundaram “Á first course in Mathematical analysis”,
Narosa Publication

Programme: B.Sc.- 1 (Semester- II), Mathematics

Syllabus Prescribed for the year 2022-23 , UG Programme

Programme : B.Sc.-I

Semester II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC-III / Mathematics	Ordinary Differential Equations	9+1

COs: After completing this course, students would be able to

1. Solve first order differential equations using different techniques..
2. solve higher order differential equations and orthogonal trajectories.
3. calculate complementary function and particular integral of the second order differential Equation.
4. Describe the different methods to solve second order differential equations.
5. illustrate applications of differential equations .

Unit	Content
Unit I	Formation of ordinary differential equation, degree and order of a ordinary differential equation, homogeneous differential equations, linear differential equations, Bernoulli’s equation, differential equations reducible to the linear form, exact differential equations. (12 period)
Unit II	Differential equations of first order and higher degree, differential equations solvable for p, x and y, Clairaut’s equation, orthogonal trajectories (Cartesian and Polar form) (12 period)

Unit III	Linear differential equations with constant coefficients, complementary function of the differential equation, particular integral of the differential equation, homogeneous linear ordinary differential equations. (12 period)
Unit IV	Second order differential equation, Wronskian, method of change of dependent variable, normal form, method of change of independent variable, variation by parameters. (12 period)
Unit V	Applications of ODE: Electric circuit, steady state heat flow, radio active decay and carbon dating, Newton’s law of cooling, compound interest. (13 period)
*SEM	
COs: 1.To enhance interest among the students about course. 2.To develop the learning and writing skills. 3.To create mental ability.	
**Activities	1. Unit Test 2. Assignment/ open book test 3. Quiz/ Study Tour

Text books :

1] T.M.Karade , V. G. Mete, V.S.Bawane , P.R. Agrawal , A.Y.Shaikh ,R.V.Kene: Differential Equations (Ordinary and Partial), Sonu-Nilu, Nagpur, 2022.

2] V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari: A Text book of , Ordinary Differential Equations, Dnyanpath Publication,Amravati, First Edition, 2022.

Reference Books :

1] Ayres F Jr.: Differential equations, Schaum's outline series, McGraw Hill, 1981.

2] Coddington: An Introduction to Ordinary Differential Equations, E.A.Prentice Hall of India, 1998.

3] T.M.Karade, N.T.Karade: Ordinary Differential Equations, Sonu-Nilu. Nagpur, 2016.

4] Murray D.A.: Introductory course in Differential Equations, Orient Longman(India), 1967.

5] Piaggio HTS: Differential Equations, CBS Publishers &Distributors, Delhi, 1985.

6] Siminons G.F.: Differential Equations, Tata McGraw Hill, 1972.

7] A.R.Forsyth. A Treatise on Differential Equations. Macmillan and Co.Ltd.London.

8] H. K Dass, Advanced Engineering Mathematics, S. Chand Publication, 2010.

9] B.S.Grewal, Higher Engineering mathematics, Khanna Publisher, New Delhi, 2017.

Programme: B.Sc.- I (Semester-II), Mathematics

Part B

Syllabus Prescribed for the year 2022-23 , UG Programme

Programme : B.Sc.-I

Semester- II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC –IV/ Mathematics	Vector Analysis and Geometry	9+1

COs: After completing this course, students would be able to

- 1. interpret the vectors, their products, differentiation and integration.
- 2. determine curvature and torsion .
- 3.apply the concepts of divergence, curls which are useful in physics.
- 4.. describe the different forms of sphere and properties.
- 5. discuss the equations of cone and cylinder.

Unit	Content
Unit I	Scalar and vector product of three vectors, product of four vectors, vector differentiation and vector integration. (12 period)
Unit II	Space curve, t, n, b vectors, fundamental planes, curvature, torsion, Frenet- Serret formulae. (12 period)
Unit III	Gradient, divergence and Curl, directional derivative, line integral and work done, circulation. (12 period)
Unit IV	Sphere: Different forms of sphere, section of a sphere by a plane, sphere through a given circle, intersection of spheres and a line, orthogonal spheres and condition of orthogonality. (13 period)
Unit V	Cone : The equation of a cone with a guiding curve, cone with vertex and origin, right circular cone. Cylinder: equation of right circular cylinder. (12 period)
*SEM	
COs: 1.to enhance interest among the students about course. 2.to develop the learning and writing skills. 3.to create mental ability.	
**Activities	1. Unit Test 2. Assignment/ open book test 3. Quiz/ Study Tour

Text books :

1] T.M.Karade, Maya S. Bendre, V. B Raut, R.S.Wadbudhe, S.B.Tadam, V.D.Elkar ,K.R.Muley: Vector Analysis and Geometry, Sonu Nilu , Nagpur,2022.

2] V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari: A Text book of , Vector Analysis and Geometry, Dnyanpath Publication,Amravati, First Edition, 2022.

Reference Books :

1] Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York,1981.

2] N.Saran and S.N.Nigam , Introduction to vector Analysis Pothishala Pvt.Ltd.Allahabad.

3] Shanti Narayan, A Text Book of Vector Calculus, S.Chand & Co. New Delhi.

4] R.J.T.Bell, Elementary Treatise on Co-ordinate Geometry of Three Dimensions, Macmillan India Ltd., 1994.

5] P.K.Jain and Khalil Ahmad, A Text Book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd., 1999.

6] N.Saran and R.S.Gupta, Analytical Geometry of three dimensions, Pothishala Pvt.Ltd. Allahabad,2000.

Programme: B.Sc.- I (Semester-II), Mathematics

Part B

Syllabus Prescribed for the year 2022-23 , UG Programme

Programme : B.Sc.-I

Semester- II

Code of the Course/Subject Title of the Course/Subject (Total Number of Periods/week)

GIC/ Mathematics Numerical Ability-I ----

COs: After completing this course, students would be able to

- 1. restate the ideas and concept of HCF & LCM of number and also find square root & cube roots.
- 2. illustrate the problem on numbers, ages, percentage, profit and loss.
- 3. analyze ratio and proportion , time , work and distance.
- 4. outline the problems on train, simple interest, compound interest, area measurement.
- 5. create the Bar graphs, Pie charts and Line graphs.

Unit	Content
Unit I	HCF & LCM of number, Decimal fraction, Simplification, Square root & cube roots.
Unit II	Average, Problem on numbers, Problem on ages, Percentage, Profit & Loss.
Unit III	Ratio & Proportion, pipes and cisterns, Time and work, Time and Distance.
Unit IV	Problem on train, Simple Interest, Compound Interest, Area.
Unit V	Bar Graphs, Pie Charts, Line Graphs.

Reference:

- 1) R. S. Agrawal, Quantitative aptitude for Competitive examination, S. Chand Publication
- 2) Arun Sharma, How to Prepare for quantitative Aptitude for CAT, Mac Grow Hill Publication

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B Sc (Microbiology)

POs:

Students of undergraduate general degree programme at the time of graduation would be able to –

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, check out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest contexts socio-technological changes.

PSOs:

Upon completion of the programme successfully, The students would be able to

1. gain insight of Microbiology starting from history and fundamental knowledge about the microorganisms.
2. acquire the skill in the use and care of basic microbiological equipment and can perform basic laboratory procedures in microbiology.
3. be well-informative about the integral role of microorganisms and different branches of Microbiology.
4. Be acquainted with the basic concept of prokaryotes, their taxonomy, their differentiation from eukaryotes.

Employability Potential of the Programme:

Microbiology is a branch of science that deals with study of microorganisms. The microbiological study has wide range of scope ranging from basic sciences to applied sciences. Microbiological study is mainly focused on causative agents of various diseases, microorganisms of agricultural, environmental and industrial use. The production of antimicrobial drugs to cure various diseases is covered in this discipline. Here is an overview of job opportunities where our students has explored and would be helpful for upcoming students as well.

Medical microbiology refers to the use of microbiology in the healthcare industry. Microbiology firms are at the heart of the healthcare industry, whether they're developing diagnostic kits, vaccines, biologics, pharmaceuticals, or medical gear. Microbiology fields such as molecular biology, cell biology, recombinant technology, and immunotherapeutics benefited from the medical sector's evolution. For those interested in a career in Medical Microbiology, there are numerous career prospects in Research and Development, Pharmaceutical Companies, Hospitals, Diagnostic Centers, Manufacturing Sector of Microbiology, and Academic Sector. Many of our students have joined as Microbiologist at renowned pharmaceutical companies. Our students have also joined COVID-19 diagnostic laboratories across various districts, thus helping the society. Beside these students has also joined

vaccine manufacturing institutions.

Previously, this field only focused with the discovery and development of small molecules (drugs), but the industry has evolved throughout time. This industry's horizon has widened. Biopharmaceutics has added a new dimension to the industry. The use of microbiology in drug research and discovery has always been a component of the process, but the addition of biologics as therapeutic elements has resulted in a rise of biotech businesses in the pharmaceutical sector. To begin, consider cell-based treatments, monoclonal antibodies, vaccinations, and other medicines. In this regard our students has got jobs in various pharmaceutical industries.

Low crop yield, crop quality deterioration, weeds, loss of soil fertility, abiotic stress, and biotic stress are just a few of the issues that have plagued agriculture. Microorganisms are also helpful in enhancing the crop productivity. Our students are entrepreneur in this field. The biofertilizers are produced in bulk and are commercialized by few of our students. Incidentally biofertilizers are ecofriendly.

Food microbiology overcomes challenges in food production, processing, and preservation. The production of value-added food products are the greatest examples. Almost all food industries need pure water. The bacterial quality of water is tested by microbiologist. Food industry provides large scope for microbiologist. Our students have occupied jobs at different food industries. Microbiology always helps in introducing technology which aims to enhance the production, processing, packaging and preservation of food also.

Environment microbiology aims to restore the balance between nature, ecology and human interest. Bioremediation and biological intervention is only possible by the way of utilization of techniques of microbiology. All these issues are now being addressed by using biotech processes. Microbes like bacteria, fungi algae and plants are being used in the process of bioremediation.

Beside job opportunities in the sector of agriculture, pharmaceutical and food industries our students are working as research fellow at various National Institutes. Many students are working as Assistant Professor in colleges, Laboratory Technicians at Government and private pathological laboratories.

Syllabus Prescribed for 1st Year UG Programme

Programme: B Sc

Semester 1

Code of the Course/Subject Title of the Course/Subject (Total Number of Periods)

MCB1 FUNDAMENTALS OF 90
MICROBIOLOGY AND
MICROBIAL
PHYSIOLOGY

COs

Upon completion of this course successfully, students would be able to

- 1. get knowledge of historical aspects of microbes and their importance as well as application in day to day life.
- 2. differentiate the microbes on the basis of their characteristics and apply the classification scheme for identification.
- 3. demonstrate the structure of prokaryotic and eukaryotic cell.
- 4. illustrate different types of microscopes and staining techniques.
- 5. compare and design different nutritional media for microbial growth.

Unit	Content
Unit I A. History of Microbiology B. Introduction and Scope of Microbiology	A. History of Microbiology: a. Discovery of microscope- Contribution of Antony von Leeuwenhoek, Robert Hook. b. Controversy over Spontaneous generation: Contributions of Redi, Needham, Schulze and Schwan, Schroder & Van Dusch, Louis Pasteur c. Contribution of pioneers in development of microbiology : Louis Pasteur (fermentation & Vaccine) Alexander Fleming (Antibiotic) Joseph Lister (Antiseptic surgery), Edward Jenner (Small pox Vaccine) Robert Koch (Germ theory of diseases, Koch postulates & ure culture concept) B. Introduction and Scope of Microbiology a. Introduction of microorganisms and their distribution in nature b. Beneficial and harmful activities of microorganism c. Basic branches of Microbiology: Bacteriology, virology, mycology, phycology, parasitology.

	d Applied branches of Microbiology : Environmental Microbiology, Medical microbiology Industrial Microbiology, Food and Dairy Microbiology, Genetic engineering and Biotechnology. (15 periods)
Unit II Microbial diversity & Classification:	A. Microbial Diversity: General characteristics of : - Bacteria - Viruses - Rickettsia - Actinomycetes - Archae - Fungi (Including yeasts) - Algae B. Bacterial Classification: - Definition- Taxonomy, Classification, Taxonomic rank, Identification, Nomenclature - Bergey's manual of systematic Bacteriology, General characteristics enlisting all parts with major characters and examples (Vol.I to IV) - Methods of Classification: Numerical taxonomy, Genetic relatedness: r-DNA sequencing & phylogenetic tree (15 periods)
Unit III Structural Organization of Bacteria:	Structural Organization of Bacteria: - Structure of prokaryotic and Eukaryotic cell, its Comparison and Differences. - Typical Bacterial cell - Shape, Size, and Arrangement of Bacteria - Structure and functions of following - Capsule and slime layer - Cell wall- Gram positive and Gram negative bacteria. - Cytoplasmic membrane- fluid mosaic model - Flagella- Arrangement, Mechanism of flagellar movement. - Pili-Arrangement and function - Ribosomes- Prokaryotic and Eukaryotic - Plasmid- Definition, General characters, classes - Bacterial chromosome - Endospores- Structure and arrangements. (15 periods)
Unit IV Microscopy and Staining	A. Microscopy: Definition: Magnification, Resolving power, numerical aperture, focal length

	b) Principles, construction, ray diagram and applications: i) Compound Microscope ii) Dark field microscope iii) Electron Microscope. c. Introduction & application of Fluorescent and Phase contrast Microscope B. Staining: a) Dyes and Stains- auxochromes, chromophore, mordant b) Principles and Methods of the following techniques: i. Simple staining ii. Differential staining- Gram stain, Acid fast and Endospore staining (15 periods)
Unit V Microbial Nutrition and Pure Culture Techniques	A. Microbial Nutrition: i. Basic Nutritional Requirements: Sources of C, N, O, P, S, Energy, Macronutrients, Growth factors, water etc. ii. Media, Synthetic, Nonsynthetic, Liquid and Solid, Semisolid, Differential, Enriched, Selective media. Role of beef extract, yeast extract, peptone, agar in nutrient media. iii. Determination of nutritional requirements: Auxanographic technique, Replica plating technique. iv. Nutritional classification on the basis of source of carbon and energy B. Pure Culture Techniques: i. Definition- Pure and Mixed culture ii. Methods of Isolation of Pure culture- Streak plate, pour plate and Enrichment culture. iii. Methods of preservation of pure culture- Agar slants, Saline suspension, Overlaying with oil, glycerol stock, Freeze drying/ Lyophilization. iv) Introduction of Microbial cultural collection centre- ATCC, ITCC, MTCC and NCIM (15 periods)
Unit VI if applicable	Not Applicable
*SEM Basic Skills of Microbiological Laboratory A. Handling and caring of different instruments used in Microbiology laboratory: 1. Microscope 2. Autoclave 3. Hot air oven 4. Laminar air flow cabinet	

B. Preparation of Nutrient media: i. Nutrient broth ii. Nutrient agar iii. PDA C. Motility of bacteria D. Isolation and maintenance of microorganism - Isolation of fungi by slide culture technique - Isolation and Maintenance of pure culture of bacteria by - Agar slants, Saline suspension, Glycerol stock, Overlaying with oil, Freeze drying.	
COs: 1. Student will be able to get employment in different laboratories related with Microbiology work. 2 Student will be able to get employment in Microbial culture collection centers dealing with isolation, identification and maintenance of microorganism.	
**Activities	1. Demonstration 2 Assignment 3 Project 4. Task 5. Field visit (15 periods)

Course Material/Learning Resources

- 1) General Microbiology : Stainer, Roger et. al.
- 2) General Virology : Luria, S.E.
- 3) Fundamentals Principles of : A.J. Salle. bacteriology
- 4) Microbiology : Pelczar, Chan, Krieg.(TMH)
- 5) Text Book of Microbiology : Dubey & Maheshwari (S.Chand, Publication)
- 6) Fundamental of Microbiology : Frobisher
- 7) General Microbiology Vol. I & II : Power & Dagainawala. (Himalaya Publication)
- 8) Zinsser Microbiology : W.K. Joklik
- 9) General Microbiology : W.G. Walter
- 10) Elements of Microbiology : M.J. Pelozar & E.C.S. Chan
- 11) Essays in Microbiology : J.N. Norris & M.H. Richmond
- 12) Microbiology : L. Mckane & J. Kandel (Essentials & Applications)
- 13) Basic Microbiolgy : Volk
- 14) Chemical Microbiology : Rose
- 15) Elementary Microbiology : Modi (Akta Prakashan) Vol. I & II
- 16) Basic experimental : Ronald M., Atlas, & Alfred Microbiology Miller E.Brown, Kenneth W. Dobra, Lionas (1986) (Prentice Hall - 316 PP)
- 17) General Microbiology : Robert F.Boyd (1984) times mirror / mosby college, Pub. 22 PP

List of Books For PRACTICALS

- 1) Microbes in Action : Seely, Wander Mark Tarporewala, Bombay
- 2) A Mannual of Microbiology : A.J. Salle. Methods

- 3) Medical Microbiology Vol. II : R. Cruickshank
- 4) Microbiology Methods : Collins
- 5) Difco manual
- 6) Bacteriological Techniques : F.J.Baker
- 7) Introduction to Microbial : Gunasekaran Techniques
- 8) Biochemical methods : Sadashivam & Manickam
- 9) Laboratory Fundamentals of : Alcamo, I.E., Jones and Microbiology Bartlett Publishers.
- 10) A textbook of Practical Microbiology (B Sc Sem 1 &2) : Dr. R. R. Pachori, P.S.Sadar, Dr. A. M. Pande, 2nd Edition

Weblink to Equivalent MOOC on SWAYAM if relevant:

Weblink to Equivalent Virtual Lab if relevant:

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

Sant Gadge Baba Amravati University, Amravati		
Syllabus Prescribed for 1 st Year UG Programme		
Programme: B. Sc		
Semester 1		
Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
MCB lab1	FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL PHYSIOLOGY Lab 1	06/week/batch

COs

Upon completion of this course successfully, students would be able to

- 1. acquire the skill in the use and care of basic Microbiological equipment.
- 2. perform basic laboratory procedures in microbiology; proper collection and forwarding of microbiological and parasitological specimens to the laboratory.
- 3. demonstrate different staining techniques.
- 4. acquire skill in bacterial motility.

*** List of Practical/Laboratory Experiments/Activities etc.**

1	1. Study and use of different instruments use in Microbiology Laboratory i. Autoclave ii. Hot air oven iii.Bacteriological Incubator iv. Laminar air flow
2	2. Demonstration of bacteria from; Soil, Water, Air, Milk, Skin
3	3. Microscopic Examination of bacteria i. Monochrome/ simple staining ii. Gram’s staining iii. Negative staining iv. Endospore staining
4	4. Demonstration of bacterial motility by Hanging drop technique
5	5. Cultivation and Demonstration of i. Yeast- Saccharomyces cereviceae, Candida albicans. ii. Mold- Penicillium, Aspergillus
6	6. Demonstration of a) Protozoa-E.histolytica, Paramoecium b) Algae –Nostoc, Spirogyra
7	7. Isolation of bacterial Pure culture by i) Streak plate ii) Pour plate

Syllabus Prescribed for 1st Year UG Programme

Programme: B.Sc

Semester II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
MCB 2	GENERAL AND APPLIED MICROBIOLOGY	90

COs

Upon completion of this course successfully, students would be able to

1. apply the knowledge of bacterial growth in industrial productions and determine the growth of bacteria.
2. demonstrate the nature, structure, general properties and replication of viruses as well as acquainted with the knowledge of interferon.
3. apply the concept of microbial control methods for prevention against infections.
4. formulate different microbial products using production strains of microorganisms.
5. evaluate microbe- host relationship in nature, humans and plants.

Unit	Content
Unit I Reproduction and Growth of Bacteria:	Reproduction and Growth of Bacteria: a) Reproduction: Binary fission, Budding, Fragmentation, Sporulation, b) Growth rate and generation time- Definition, mathematical expression. c) Bacterial growth curve d) Synchronous culture: Definition, methods of isolation (Helmstetter- Cummings Technique) and application. e) Continuous culture: Definition, method (chemostat, and Turbidostat Techniques) and Application. f) Measurement of Growth: i. Cell number measurement - Breed method and Colony count ii. Cell mass measurement- Turbidity measurement. g) Factors influencing bacterial Growth- Temperature, pH, Gaseous. (15 periods)
Unit II VIRUSES:	VIRUSES i) Discovery of viruses ii) Structure of viruses iii) Classification of viruses (LHT System) iv) Replication of viruses – Lytic cycle (T4), Lysogeny (Lambda phage) v) Cultivation of viruses – Embryo culture, Tissue culture method. vi) Interferon (15 periods)
Unit III MICROBIAL CONTROL	MICROBIAL CONTROL i) Definition and Terms- Sterilization, disinfection, Antiseptic, Sanitizer, Germicide, Microbiostatis, Antimicrobial agent. ii) Mechanism of cell Injury - Damage of cell

	wall, cell membrane, Inhibition of metabolic reactions. iii) Physical Control :- Temperature, osmotic pressure, Radiation, filtration. iv) Chemical Control – Chemistry and mode of action of halogens, heavy metals and their derivatives, Alcohols, Detergents and Gaseous Sterilization. v) Chemotherapeutic agents.- Definition and mode of action of penicillin , tetracycline, Norfloxacin (15 periods)
Unit IV APPLIED ASPECTS OF MICROORGANISMS IN -	APPLIED ASPECTS OF MICROORGANISMS IN - i) Agriculture – Biofertilizers & Biopesticides. ii) Medical – Antibiotics, Vaccines iii) Industrial- Outline of Industrial Microbiology and role of microorganisms in fermented food, beverages, probiotics, Single cell protein & Pharmaceutical products iv) Environmental – Bioremediation, Biodegradation (15 periods)
Unit V Microbial Interaction	Microbial Interaction A. Microbial Interaction with nature: positive, negative and neutral associations B. a) Microbial interaction with human- Normal flora of the human body- Skin, Nose & Nasopharynx, Respiratory tract, Eye, Mouth, Stomach, External ear, Intestine, Genitourinary tract b) Types of infection C. Microbial interaction with plants. a) Rhizosphere, Phyllosphere and Rhizoplane b) Mycorrhizae, fungal and bacterial endophytes c) Symbiotic Nitrogen fixation – Rhizobium, Actinorhizae d) Common plant pathogens (15 periods)
Unit VI if applicable	Not Applicable
*SEM Biofertilizer Preparation A. Introduction, History and concept of biofertilizer Scope and importance of biofertilizer Use of microorganisms for biofertilizer production Classification and characters of biofertilizer B. Production technology: Strain selection, fermentation equipment, sterilization, mass production of carrier base and liquid biofertilizer C. Specification and quality control of bio fertilizer Application technology and Marketing of biofertilizer	
COs: 1. Student can be able to start small scale unit of biofertilizer production and can work as entrepreneur. 2. Students will be able to create awareness among farmers for application of biofertilizer in farming which helps in increasing crop yield.	
**Activities	1. Demonstration 2 Assignment 3 Project 4 Task 3. Field visit (15 periods)

Course Material/Learning Resources

- 1) General Microbiology : Stainer, Roger et. al.
- 2) General Virology : Luria, S.E.
- 3) Fundamentals Principles of : A.J. Salle. bacteriology
- 4) Microbiology : Pelczar, Chan, Krieg.(TMH)
- 5) Text Book of Microbiology : Dubey & Maheshwari (S.Chand, Publication)
- 6) Fundamental of Microbiology : Frobisher
- 7) General Microbiology Vol. I & II : Power & Dagainawala. (Himalaya Publication)
- 8) Zinsser Microbiology : W.K. Joklik
- 9) General Microbiology : W.G. Walter
- 10) Elements of Microbiology : M.J. Pelozar & E.C.S. Chan
- 11) Essays in Microbiology : J.N. Norris & M.H. Richmond
- 12) Microbiology : L. Mckane & J. Kandel (Essentials & Applications)
- 13) Basic Microbiolgy : Volk
- 14) Chemical Microbiology : Rose
- 15) Elementary Microbiology : Modi (Akta Prakashan) Vol. I & II
- 16) Basic experimental : Ronald M., Atlas, & Alfred Microbiology Miller E.Brown, Kenneth W. Dobra, Lionas (1986) (Prentice Hall - 316 PP)
- 17) General Microbiology : Robert F.Boyd (1984) times mirror / mosby college, Pub. 22 PP
- 18) Introduction to Soil Microbiology : Alexander Martin
- 19) Soil Microbiology : Subbaroa N.S.

List of Books For PRACTICALS

- 1) Microbes in Action : Seely, Wander Mark Tarporewala, Bombay
 - 2) A Mannual of Microbiology : A.J. Salle. Methods
 - 3) Medical Microbiology Vol. II : R. Cruickshank
 - 4) Microbiology Methods : Collins
 - 5) Difco mannual
 - 6) Bacteriological Techniques : F.J.Baker
 - 7) Introduction to Microbial : Gunasekaran Techniques
 - 8) Biochemical methods : Sadashivam & Manickam
 - 9) Laboratory Fundamentals of : Alcamo, I.E., Jones and Microbiology Bartlett Publishers.
 - 10) A textbook of Practical Microbiology (B Sc Sem 1 &2) : Dr. R. R. Pachori, P.S.Sadar, Dr. A. M. Pande, 2nd Edition
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Sant Gadge Baba Amravati University, Amravati		
Syllabus Prescribed for 1 st Year UG Programme		
Programme: B Sc		
Semester 2		
Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
MCB Lab 2	<u>GENERAL AND APPLIED MICROBIOLOGY Lab 2</u>	06/week/batch

COs

Upon completion of this course successfully, students would be able to

- 1. acquire the skill in the use and care of basic Microbiological equipment.
- 2. get employment in diagnostic laboratories.
- 3. analyze the effect of different parameters on growth of bacteria.
- 4. determine the nutritional requirement of microorganisms.

*** List of Practical/Laboratory Experiments/Activities etc.**

1	1. Study of different Laboratory equipment's used in Microbiology i. pH meter ii. Centrifuge iii. Colorimeter/ spectrophotometer iv. Anaerobic Jar v. Bacteriological filters
2	2) Effect of salt, sugar concentration , pH & Temperature on bacterial growth
3	3) Demonstration of oligodynamic action (copper, silver)
4	4) Antibiotic sensitivity test of bacteria.
5	5) Anaerobic culture method – by Anaerobic Jar method / RCMM.
6	6) Demonstration of Replica plate technique / auxanography.

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B.Sc. (Physics)

POs:

At the time of graduation, Students will be able to

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

Upon completion of the Programme successfully, students would be able to

1. acquire a comprehensive knowledge and sound understanding of fundamentals of Physics
2. develop laboratory skills, enabling them to take measurement in a physics laboratory and analyze the measurements to draw valid conclusions.
3. be prepared to acquire a range of general skills, to solve problems, to evaluate information, to use computers productively, to communicate with society effectively and learn independently.
4. Develop good oral and written scientific communication skill.

Employability Potential of the Programme:

Physics programme develops the skills, particularly the ability to analyze and apply information, gives one a good head start, in any field, one wishes to get in. The skills are useful even in the management disciplines.

This programme gives physics enthusiasts a chance to develop their mathematical, problem solving, communication skills and critical thinking, that helps to interpret rich scientific data and that is always a boon to scientific researchers.

After accomplishing M. Sc. in Physics, student can certainly increase his/her employability in this field.

Students can easily avail of technical jobs, both in the private and public sector. Some of the common job positions or profiles for a physics enthusiast are Online tutor, College lecturer, Assistant Professor, Observation Scientist, Laboratory Technician, School Science Technician or Research Analyst, Assistant Scientist, Physics Training Manager, Software Engineer, Network Administrator, IT Consultant, Security Expert, Java Developer, Systems Support Administrator, Interface Engineer etc. They can apply for jobs in Aerospace and Defence, Automobile, IT and Software, Railways, Nuclear and Renewable energy, Oil and Gas, Electronics and Telecommunications and the Manufacturing sector.

Students can pursue an MTech/MS degree in a variety of engineering or technology disciplines such as aeronautical, automobile, instrumentation, electronics and communication, or computer sciences. But, make sure to crack the GATE (Graduate Aptitude Test in Engineering) exam first, before going down this road.

For a long career in the field of research, students are advisable to pursue MPhil or PhD in Physics, after completing MSc Physics and join any science/technology research center. Students can also apply in Government or private colleges and universities; polytechnic institutes, degree colleges, engineering

colleges, IITs, IISc etc for teaching job. The minimum requirement is MSc Physics and UGC-CSIR NET exam for lectureship and JRF. Moving on, an MSc Physics followed by a BEd can also land you a job in higher secondary schools and then, there is the option of physics tutor, at the convenience of one's homes. Some of the prominent national organizations, that student can try aim for, include Defence Research and Development Organisation (DRDO), Indian Space Research Organization (ISRO), BARC, SSPL, Space Application Centres, Indira Gandhi Centre for Atomic Research Centre, Variable Energy Cyclotron Centre, National Thermal Power Corporation (NTPC), Oil and Natural Gas Corporation (ONGC), Bharat Heavy Electricals Limited (BHEL) and National Atmospheric Research Laboratory of Department of Space.

The research institutes in India such as Physical Research Laboratory, Ahmedabad, Saha Institute of Nuclear Physics, Kolkata and Nuclear Science Centre, New Delhi, TIFR (Education); IISER also recruit MSc Physics graduates, for technical jobs. At the same time, student can also look out for the national laboratories and institutes like National Geographical Research Institute, Regional Research Laboratories, National Institute of Science Communication and Information Sources, NEERI (CSIR labs) etc. These are some of the leading names to be associated with the field of science. Moving further, student can try for public sector banking to the post of Probationary Officers.

MSc Physics graduates have ample of opportunities, be it, in healthcare, manufacturing and electronics companies in most foreign countries. Those with exceptional academic excellence can go a step further and apply in the best space research organizations such as National Aeronautics and Space Administration (NASA).

After completion of this programme, the students are placed as Scientists, Radiologist, Meteorologist, Analyzers in forensic labs, IAS, SDO, Dy Superintendent of Police in wireless stream, Assistant Professors, Lecturers, Teachers, Radiologist, Telecom officers (JTO).

Syllabus Prescribed for B.Sc. I Year UG Programme
Programme:
Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
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PHY/S1CS	Mechanics, Properties of matters, Oscillations & Relativity	72
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COs

On successful completion of this course, the students would be able to

1. Discuss the basic concepts of rotational dynamics.
2. Examine the phenomenon of simple harmonic motion and distinction between undamped, damped and force oscillations and the concept of resonance.
3. Explain the superposition of simple harmonic motion and acquire the knowledge of Ultrasonic waves, their production, detection and applications in different field.
4. Determine the constants of elasticity and relate it with appropriate things
5. Interpret the postulates of special theory of relativity.
6. Know the concept of Global positioning system (GPS)

Unit	Content
Unit I	Rotational Dynamics: Rigid body, Torque, Rotation about fixed axis, Kinetic Energy of rotation, moment of inertia and its physical significance, Radius of gyration, Perpendicular and parallel axes theorem (Statement Only), Fly-wheel, Moment of inertia of different bodies (Rod, Disc, cylinder and sphere) about different axes, Rolling motion. Principle of Conservation of Angular momentum. Principle and working of Gyroscope. Numericals 12 (periods)
Unit II	SHM and its solution, time period of simple pendulum, compound pendulum, kater's pendulum & Torsional pendulum; Bifilar pendulum (Qualitative). Damped Oscillations: Differential equation of damped harmonic oscillator and its solution, Energy equation of damped oscillations, Power dissipation and Quality factor. Forced Oscillations: Differential equation of forced oscillation (Qualitative), Resonance (Amplitude). Numericals 12 (periods)
Unit III	Superposition of S.H.Ms.: Superposition of two SHM of same frequency along the same line, superposition of two mutually perpendicular SHM of same frequency, Lissajous figures. Velocity of longitudinal waves (Newton's formula), Laplace correction, velocity of transverse waves in stretched string, Standing waves, Organ Pipe, harmonics and overtones. Velocity of waves by Kundt's tube. Ultrasonic waves: Production (piezoelectric crystal and Magnetostriction) and detection of ultrasonic waves and its applications in medical and industrial field. Numericals 12 (periods)
Unit IV	Elasticity: Different types of elasticity, Twisting couple on a cylindrical rod or wire, Determination of modulus of rigidity by Maxwell needle, Torsional pendulum, Torsional oscillations, Modulus of rigidity of a material of wire by torsional pendulum, Beam, Bending of beam, Bending moment, External and internal bending moments, Cantilever, Expression for depression of a beam (i) loaded at one end and (ii) loaded at the center. Numericals 12 (periods)
Unit V	Gravitation and Special Theory of Relativity: Kepler's laws of planetary motion (Statements only), Newton's law of gravitation, Variation of "g" with altitude and depth, weightlessness, Satellite in circular orbit and applications, Geosynchronous orbit, basic idea of Global Positioning System(GPS). Frame of reference, Inertial and Non-inertial frame of reference, Galilean transformation, Postulates of special theory of relativity, Lorentz transformation, length contraction, Time dilation, Einstein's mass energy relation. Numericals 12 (periods)
*SEM Basics of Measurement Technique Measurements: Significance of measurements, methods of measurements, Static and dynamic characteristics: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements: Types of errors: i) Gross errors ii) Systematic errors iii) Random errors and loading effects. Statistical evaluation of measurement data: Arithmetic mean & median, Average deviation: Measurement with Screw Gauge, Vernier Caliper, Travelling Microscope, Spectrometer. (12 periods)	
COs: After completion of this course students will able to 1. apply the principles of measurement and error analysis. 2. Develop the skills to handle various instruments with precision.	

**Activities	1. Measurement of dimension of solid block, volume of cylindrical objects, diameter of thin wire. 2. Measurement of length and diameter of capillary tubes. 3. Comparison of diameter of a thin wire using screw gauge and travelling microscope. 4. Measurement and estimation of errors in any one of the above activities.
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Course Material/Learning Resources

Text books & Reference Books:

1. A Course in electrical &Electronic Measurements And Instrumentation by A. K. Sawhney, Dhanpatrai& Company (Pvt.) Ltd. Educational & Technical Publishers,
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper. PHI Learning Pvt. Ltd. New Delhi.
3. Measurement, Instrumentation And Experiment Design In Physics And Engineering By Michael Sayer, AbhaiMansingh, Phi Learning Private Ltd. New Delhi.
4. Electronic Instrumentation by H.S. Kalsi
5. Elements of Electronic Instrumentation and Measurement by Joseph J. Carr
6. A text book in Electrical Technology - B L Theraja - S Chand and Co.
7. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
8. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
9. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
10. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning
11. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
12. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
13. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
14. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley

Weblink to Equivalent MOOC on SWAYAM if relevant:

<https://nptel.ac.in>

Weblink to Equivalent Virtual Lab if relevant:

<https://vlab.amrita.edu/>
<https://www.vlab.co.in/>
<http://vlabs.iitb.ac.in/vlab/labsps.html>

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

<https://youtube.com/playlist?list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e>

Syllabus Prescribed for B.Sc. I Year UG Programme		
Programme: Semester 1		
Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)

PHY/S1	Physics Lab-1	6
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COs

- On successful completion of this practical course, the students would be able to
1. List out, identify and handle various equipment likes different types of pendulum.
 2. Learn the procedures of operation of various oscillating objects.
 3. Acquire skills in observing and measuring different types of errors.
 4. Perform procedures and techniques related to experiments based on mechanics.
 5. Conduct an experiments collaboratively and ethically.

*** List of Practical/Laboratory Experiments/Activities etc.**
It is necessary to perform **TEN** Experiments from the list given below.

1	To determine acceleration due to gravity by Bar pendulum.
2	To determine acceleration due to gravity by Kater’s reversible pendulum.
3	To study oscillations in bifilar suspension arrangement
4	To determine Moment of Inertia of a body by a torsion pendulum.
5	To study the theorem of parallel axes of Moment of Inertia
6	To study the theorem of perpendicular of Moment of Inertia
7	To determine the Moment of Inertia of a body using bifilar suspension method (with parallel threads)
8	To determine the moment of inertia of a fly-wheel.
9	To determine the i) equivalent length, ii) radius of gyration, iii) moment of inertia of a compound pendulum by method of coincidences
10	To study the oscillations of a mass in combinations of two springs and hence determination of force constant.
11	To show that the frequency of a Helmholtz resonator varies inversely as the square root of its volume and to estimate the neck correction.
12	To determine Young’s modulus of the material of a beam by method of vibration.
13	To determine Young’s modulus of the material of a beam by method of bending.
14	To determine Young’s modulus of the material of a beam by a cantilever.
15	To determine the Young's Modulus of a Wire by Optical Lever Method.
16	To determine modulus of rigidity of material of a given wire by Maxwell’s needle.
17	To determine the modulus of rigidity of material of a given wire by using Torsional pendulum.
18	To determine coefficient of restitution for inelastic collision.
19	To determine the surface tension of mercury by Quinke’s method

Text books & Reference Books:

- 15. *B.Sc. Practical Physics* by Harnam Singh & Dr. P. S. Hemne , 2000, S. Chand and Company Limited.
- 16. *A Textbook of Practical Physics* by Indu Prakash, Ram Krishna & A. K. Jha, 2011, Kitab Mahal Publication.
- 17. *B.Sc. Physics Practical* by C. L. Arora, 2010, S. Chand and Company Limited.

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Weblink to Equivalent Virtual Lab if relevant:
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Faculty: Science and Technology
Programme: B.Sc.

Syllabus Prescribed for **B.Sc. I Year** UG Programme
Programme:
Semester 1I

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
PHY-S2/physics	Electrostatics, Magneto-statics, Ultrasonic Waves and Acoustics, Network Theorems	72

COs

- After going through the course, the student would be able to
- 7. Discuss the concept of scalars & vectors and their properties.
 - 8. Develop an understanding of Gauss law and its applications to obtain electric field in different cases.
 - 9. Formulate the relationship between electric displacement vector, electric polarization and dielectric constant.
 - 10. Distinguish between the magnetic effect of electric current, electromagnetic induction and the related laws in appropriate circumstances.
 - 11. Simplify electrical circuits by applying various network theorems.

Unit	Content
Unit I	Vector Analysis: Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors. Numericals (12 Periods)
Unit II	Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Relation between electric field and electric potential. Numericals (12 Periods)
Unit III	Capacitors: Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. Numericals (12 Periods)
Unit IV	Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. Numericals (12 Periods)
Unit V	Network Theorems : Series circuit, Series voltage dividers, Parallel circuits, Series Parallel circuits, Resistances in series and parallel, Kirchhoff's Current and Voltage laws, Wheatstone's Bridge, Ideal constant voltage source, Ideal constant current source, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Milliman's theorem, Numericals. (12 Periods)
*SEM Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Introduction to electrical components: Resistor -Types of Resistors, Color coding - Applications of a Resistor as a heating element in heaters and as a fuse element. Capacitor - Types of Capacitor, Color coding, Applications of Capacitor in power supplies, motors (Fans) etc. Inductor -Types of Inductors, EMF induced in an Inductor, Applications of Inductor in a fan, radio tuning	

circuit and Series resonance circuit. Energy audit: Unit of electricity, power of domestic appliances. (12 periods)	
COs: After completion of this course students would be able to 3. Make use of Multimeter for the measurement of electrical parameters and get the knowledge of electronic components and their applications. 4. Estimate the power consumption of domestic appliances and carry out energy audit.	
**Activities	1. Use of Multimeter for the measurement of ac voltage & dc voltage in different domestic appliances. 2. Use of Multimeter for the measurement of Resistance, Capacitance. 3. Estimate the values of Resistor & capacitor by color code method. 4. Connect two or three resistors or capacitors or inductors and measure the Series, Parallel Combination values using a Multimeter. 5. Identification of electronic components in mobile charger and to estimate their values. 6. Estimate and compare the power consumptions of different domestic appliances. 7. Energy audit of your home and compare it with monthly electric bill (for three months).

Course Material/Learning Resources

Text books & Reference Books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
6. A Course in electrical & Electronic Measurements And Instrumentation by A. K. Sawhney, Dhanpatrai & Sons Educational & Technical Publishers, Delhi.
7. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper. PHI Learning Pvt. Ltd. New Delhi.
8. Physics for degree students (B.Sc.2nd year) by C. L. Arora & P.S. Hemne, S. Chand Publication.
9. Physics for degree students(B.Sc. 1st year)by C. L. Arora & P.S. Hemne, S. Chand Publication.
10. Basic Electronics by B. L. Theraja, S. Shand Publication.
11. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
12. Properties of Matter and Acoustics for B.Sc, Kiruthiga Sivaprasath & R Murugesan, S. Chand & Co. New Delhi.

Weblink to Equivalent MOOC on SWAYAM if relevant:

<https://nptel.ac.in>

Weblink to Equivalent Virtual Lab if relevant:

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<https://www.youtube.com/watch?v=rtIJoXxISFE&list=PLyQSN7X0ro2314mKyUiOILaOC2hk6Pc3j>

Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for B.Sc. I Year UG Programme

Programme: Semester II

Code of the Course/Subject	Title of the Course/Subject	(No. of Periods/Week)
	(Laboratory/Practical/practicum/hands-on/Activity)	

PHY/S2	Physics Lab-2	72
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COs

- On successful completion of this practical course, the students would be able to
6. Simplify various electrical circuits by using network theorems.
 7. Learn the procedures of operation of electrical components like capacitor, resistor and inductor.
 8. Acquire skills in measuring dielectric constants of different materials.
 9. Perform procedures and techniques related to experiments based on electrical and electronic circuits.
 10. Conduct an experiments collaboratively and ethically.

* List of Practical/Experiments/Activities etc.

It is necessary to perform **TEN** Experiments from the list given below.

1	Verification of Kirchhoff's Current Law
2	Verification of Kirchhoff's Voltage Law
3	To determine unknown resistance by using Wheatstone's bridge
4	Verification of Thevenin's theorem.
5	Verification of Norton's theorem.
6	Verification of Milliman's theorem.
7	To verify the Superposition theorem
8	To verify Maximum Power Transfer Theorem
9	To determine high resistance by leakage method
10	To study the charging & discharging of a condenser through resistor.
11	To compare capacitances using De Sauty's bridge.
12	To determine capacitance by phaser diagram method
13	To determine inductance by phaser diagram method
14	Study of Primary & Secondary coil of Transformer
15	To determine dielectric constant of a given material
16	Study of frequency response of series LCR circuit
17	Comparison of capacities by repeated charge decay method
18	Measurement of the low resistance by Potentiometer

Text books & Reference Books:

18. *B.Sc. Practical Physics* by Harnam Singh & Dr. P. S. Hemne , 2000, S. Chand and Company Limited.

19. *A Textbook of Practical Physics* by Indu Prakash, Ram Krishna & A. K. Jha, 2011, Kitab Mahal Publication.

20. *B.Sc. Physics Practical* by C. L. Arora, 2010, S. Chand and Company Limited.

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Sant Gadge Baba Amravati University Amravati

Syllabus Prescribed for 2022-23 UG Programme

B. Sc. Zoology

Faculty of Science and Technology

POs:

At the time of graduation, Students will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs

By the end of the programme, Students would be able to

1. Develop a deeper sense with respect to phylum Protozoa to Echinodermata relation to taxonomy, classification, body organization and general characteristics this strengthens students' capability in basic zoology.
2. grasp various the Systematic positions from Protozoa to Echinodermata their pathogenicity and its epidemiology.
3. describe unique characters and recognize life functions of Protozoa, Porifera, Coelenterate, Helminthes, Arthropoda, Annelida, Mollusca and Echinodermata. Improve ability and apply Knowledge of Non-chordates for its execution in Agriculture especially with the phylum Arthropoda.
4. Implement an extensive idea about economic and ecological significance of various non-chordates phylum's in human life.

Employability Potential:

The B. Sc. Zoology is a walk for the Bachelor's entrant through the amazing diversity of living organism from simple to complex. BSc Zoology Programme scope is very rewarding owing to the relevancy of the course. B.Sc. Zoology employability can be found in both the private and public sectors.

The course makes a detail comparison of the systematic study of different taxa of Non-chordate. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.

Zoology deals with the structure, embryology, evolution, classification, habits, and distribution of all animals, both living and extinct. If you are interested in making a career in Zoology then you need to deal with both the existing, dead and quite possible the extinct species of the animal kingdom.

A zoologist might even get to travel because the nature of his / her job. Channels like **National Geographic, Animal Planet, Discovery Channel** are in constant need of Zoologists for research and documentaries. Zoologists are also hired for zoos, wildlife services, botanical gardens, conservation organizations, national parks, nature reserves, universities, laboratories, aquariums, animal clinics, fisheries and aquaculture, museums, research, pharmaceutical Companies, veterinary hospitals, etc.

There are various sectors of employment in the field of Zoology. Here's the list of job profiles:

Jobs are available with a wide range of organisations in the public, private and not-for-profit sectors. Typical employers include:

- Zoos or wildlife parks and environmental protection agencies
- Government agencies and research institutions
- Medical research establishments and the National Health Service
- Environmental and animal charities
- Schools, colleges, science centres, libraries and museums
- Universities and research institutes
- Environmental consultancies
- Chemical, pharmaceutical and petroleum companies
- Aquaculture and animal nutrition companies.
- **Wildlife Biologist:** In the current scenario of global warming, mankind needs to pay attention to conserving the wildlife. Main concern of wildlife biologist are conservation and propagation of wildlife.
- **Community development organizations:** Ideal places to apply theoretical knowledge in real life settings. You can also join a number of organizations to pursue career in community development like:
 - Zoo Outreach Organization
 - Dr. Salim Ali School of Ecology
 - Indian Tiger Welfare Society
 - Wildlife Trust of India
 - Bombay Natural History Society (BNHS)
 - Protection Society of India
 - Ashoka Trust for Research in Ecology and the environment (ATREE) etc.
 - Central Zoo Authority (CZA)
 - Regional Resource Centers of Ministry of Environment and Forest Wildlife
 - Wildlife Information Liaison Development
 - Center for Science and Environment (CSE)
- **Indian Forest Services (IFoS):** A candidate can take IFoS exam conducted by Union Public Services Commission (UPSC). The upper age limit is relaxable up to 5 years for the candidates belonging to categories: Scheduled Caste/ Scheduled Tribe (SC /ST).

- **Research work:** If student is keen in research then he/she can apply for IISc., IISER, TIFR, NCBS, JNCASR, etc. for an Integrated MSc-PhD program or pursue advanced degree in wildlife biology or ecological sciences in various institutes.
- **Freelance consultant:** Student may also work as a freelance consultant in various research and development organizations.

This is a great **career** interest for students, who are fascinated with nature and would not mind spending time understanding it. There are several specializations that the students pursuing the field can venture into.

Many research agencies recruit expert students for various research projects for environmental research, animal biodiversity research, conservation of wildlife, environmental management research and monitoring of ecosystems etc.

B.Sc. Zoology Student has ample opportunities as Zoology teacher, Lab Assistant, Conservationist, Wildlife biologist, Marine Biologist, Museum Curator, Taxonomist, forensic expert, Eco-toxicologist, Biomedical Scientist, Animal Care taker, Animal and wildlife Educator, Zoo Curator, Environmental Consultant, Zoo Educator, wildlife Rehabilitator, Medical Representative, Sustainability officer, etc.

Apart from the above, private business enterprise is also one of employability potential such as, Agro Business Industry (Fish, Farming, Sericulture, Apiculture, Prawn culture, pearl Culture, Lac Culture, etc.) Clinical Business Associate, Veterinary based small scale Industry (Goat farming, poultry), Nutrition specialist.

Some top organizations also employ B.Sc. Zoology students such as Wildlife Institute of India (NII), Zoological Survey of India (ZSI), National Institute of Oceanography (NIO),

State Forest Department, Centre Marine Fisheries Research Institute (CMFRI), Central Inland Fisheries Research Institute (CIFRI), Ministry of Environment and forest, Medical Laboratories, Agricultural firms Pharmaceutical Companies, etc.

Being Zoology is a basic Science, the demand of Zoology is increasing day by day. It provides a good career option to students. It provides wide horizon of knowledge with preview of employability potential. P.G. in Zoology provides services in various sectors like, Biological Medical, Agriculture as Zoologist, Assistant Professor, Ecologist, Entomologist, Herpetologist, Department of Fishery Zoo Keeper, Zoo Officer, Marine Scientist etc.

- The students can also work in forest department by qualifying Indian Forest Service examination. They can work in sample investigator for those derived from animals in different poaching and forest crime cases. They have opportunities like Wildlife Conservationist, Forest Ranger, Zoologist, Wildlife Educator, Naturalist, Field Officer, Biomedical Scientist, Toxicologist, Marine Scientist, Medical Coder etc.

They can opt to do research-based programs or study for competitive examinations like civil services besides doing a job in a zoology-related field. They can develop entrepreneurship in the different fields like Apiculture, Sericulture, Lac culture, Pisciculture, Aquaculture, Vermiculture, etc. They can contribute as a consultant in Environment impact assessment in different projects of Dam/Road/Rail track constructions etc.

Other than this, they can opt for post PG Studies M.Phil or Ph.D or can qualify competitive exam like NET/SET/GATE to join as an Assistant Professor or as a Researcher.

A Scholar Student can join services at Bhabha Atomic Research Centre (BARC), NCBS/TIFR, NIO/ZSI etc. as a scientist.

Programme : B.Sc : I- Zoology

Name of the programme: **B.Sc. I**

Class : **Part I S**

Semester : **I**, DSC -1-01S

Subject Zoology

Name of the course (Paper): **Life and diversity of Animals (Non-chordata)**

Course Outcomes Code : COs-01

About the course

The course is a walk for the Bachelor's entrant through the amazing diversity of living organism from simple to complex. The course makes a detail comparison of the systematic study of different taxa of Non-chordate. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.

COs:

Upon completion of this course successfully, students would be able to

1. Develop a deeper sense with respect to phylum Protozoa to Echinodermata relation to taxonomy, classification, body organization and general characteristics this strengthens students' capability in basic zoology.
2. grasp various the Systematic positions from Protozoa to Echinodermata their pathogenicity and its epidemiology.
3. describe unique characters and recognize life functions of Protozoa, Porifera, Coelenterate, Helminthes, Arthropoda, Annelida, Mollusca and Echinodermata.
4. Improve ability and apply Knowledge of Non-chordates for its execution in Agriculture especially with the phylum Arthropoda.
5. Implement an extensive idea about economic and ecological significance of various non-chordates phylum's in human life.

Unit I

12 L

1. Introduction and Classification to Non-Chordata
2. Phylum Protozoa: General characters
3. Type Study: Plasmodium vivax: structure, Life cycle
4. Parasitic Protozoan and human diseases: Malaria, Amoebiasis

Unit- II

12 L

1. Phylum Porifera: General characters
2. Type study: Scypha: Habits, Habitat and Distribution, Cell types, Spicules and Structure and significance of canal system.
3. Phylum Coelenterates: General characters
4. Type study: Metridium: Habits and Habitat, External features, Gastrovascular cavity, Mesenteries, Corals and coral reefs.

Unit III:

12 L

1. Phylum Platyhelminthes: General characters
2. Type study *Fasciola hepatica*: Habits and Habitat, External features, Excretory, Reproductive system and life cycle, disease and control.
3. Phylum Aschelminths: General Characters
4. Type study: *Ascaris lumbricoides*: Habits and Habitat, External features, Digestive, Excretory, Reproductive system and life cycle.

Unit IV:

12 L

1. Phylum Annelida: General characters
2. Type study: Leech: External features, Digestive, Reproductive system.
3. Phylum Arthropoda: General characters.
4. Type study Cockroach: Habits and Habitat, Digestive, Excretory, Respiratory system, Reproductive system.

Unit – V:

12 L

1. Phylum -Mollusca: General characters
2. Type study: *Pila globosa*: Habit and habitat. External Features (Shell and body) Digestive system, Respiratory system, Reproductive system,
3. Phylum: Echinodermata: General characters,
4. Type study: *Asterias*, Habits and habitat. External Feature, Water vascular system

Unit: VI:

12 L

1. Phylum: Hemichordata : General characters, Body organisation of *Balanoglossus*, Affinities of *Balanoglossus* with Non-Chordata and Chordata.
2. Parasitic adaptation in Helminthes, Morphological and Physiological
3. Larval forms and their significance
4. *Amphiblastula*, *Planula*, *Trochophore*, *Bipinnaria*, *Brachiolaria*.

Unit VII:

20 M

Skills Enhancement Module (SEM)**1) Comparative study protozoan disease in the local area.**

- a) Procurement of resources such as reference books and data on protozoan disease in the local area.
- b) Visiting local public health Centre to fetch data on protozoan Diseases.
- c) Shortlisting most frequently occurring protozoan diseases in the area with the help of PHC authorities.
- d) Preparing data to represent the status and severity of the diseases.
- e) Submission of study report with proper inference and suggestion if available.

2) Study of hotspots regarding coral reefs from the Indian subcontinents

- a) Use of resources such as books and web to familiarise with corals, their various types and diversity and making writeup on it.
- b) Getting acquainted with the importance of coral reefs and their role in oceans.
- c) Making datasheet of few of the aquatic faunal species dependant to a large degree on coral reefs for their survival. Make an account on relationship of coral reefs with other faunal species with suitable example.
- d) Study of Economic importance of coral reefs to humans and current coral reef status throughout the Indian subcontinent.
- e) Submission of study report taking above mentioned points into consideration with the help of available resources.

3) Types of worm disease and control.

- a) Study of various worm diseases through Reference books and Internet and making list of frequently found worm diseases and getting acquainted with various modes of worm infections.
- b) Getting help from local Medical services such as Primary Health Centres and Practicing medicos to get an idea about status of worm diseases in the local area.
- c) Make a note on various treatments for worm infections, availability of treatments in the local area and methods to curb spreading of these infections.
- d) With the help of Public health Government authorities in your area make a report on their plan to prevent worm diseases and submit the study report covering all above mentioned points.

4) Diversity of Annelida in the local area.

- a) With the help of Internet and Books make list of locally occurring annelids. Procure pocket field guide to help identification of species.
- b) Getting familiarised with Procedure to Survey and study the diversity of annelids through various resources.
- c) Survey of Local area to select suitable spot to study and record various annelids.
- d) Take a record photo shot (if possible) and identify the species of annelid with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
- e) Make list of various species and their abundance in the area and submit study report taking above mentioned points into the consideration.

5) Collection of diversified Mollusc from the local water resources.

- a) Get acquainted with mollusc with the help of available material and procure primary equipment for its collection.
- b) In the suitable season survey the area to record and collect various molluscans from the nearby vicinity and make note of G.P.S location data, season, and type of habitat from where the mollusc is collected.
- c) With the help of identification guide, identify the samples and take photographs of the specimen for the report.
- d) Make list of various species and their abundance in the area and submit detailed study report taking above mentioned points into the consideration.

6) Economic importance of culture of Mollusca

- a) Use of resources such as books and web to familiarise with Molluscans, their various types and diversity.
- b) Get familiarised with the significance of molluscans and Economic importance them with reference to human context.
- c) Procure information about sites of aquaculture and species of molluscan that are commercially grown in plants in india.
- d) Mention current scenario and future of molluscan aquaculture by use of available resources.
- e) Submission of study report taking above mentioned points into consideration with the help of available resources.

7) Survey of Malarial infection from local region.

- a) With the help of available study resources get familiarised with causal animal of malaria, its vector and its life cycle. Make a list of commonly occurring parasite species in your local area.
- b) With the help of Primary Health Centre procure malarial infection incidences data.
- c) Tabulate and represent data of available years and derive inference if the severity and occurrences of malarial infections is increasing or decreasing.
- d) By contacting Public health governmental organisations procure information on various steps employed to restrict the spread of malarial infections.
- e) Submit study report taking all the above points into consideration and also include suggestions if any.

8) Survey the impact of amoebiasis infection in local population.

- a) With the help of various resources like Books and internet, understand and note down epidemiology of the disease and its status in your surrounding area.
- b) Procure information from PHC's about occurrences of the disease, its season wise frequency, commonly infected sex, age group, disease prone areas of local population.
- c) Inquire and enlist current plan of action of PHO's to contain the spread of infection.
- d) With the help of detailed data set and draw inference about its impact on public health and submit it in study report. Mention suggestions, if any.

9) Photographic collection of spiders web from the local area.

- a) With the help of Internet and Books make list of locally occurring spiders. Procure pocket field guide to help identification of species also get acquainted with webs of different spider species.
- b) Get familiarised with Procedure to Survey and study the diversity of Arachnida through various resources.
- c) Survey of Local area to select suitable spot to study and record various Arachnids.
- d) Take a record photo shot of spider and its web and identify the species of Spider with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
- e) Make list of various species and their abundance in the area and submit study report taking above mentioned points into the consideration.

10) Study of varieties of odonates surrounding area.

- a) With the help of Internet and Books make list of locally occurring Odonates. Procure pocket field guide to help identification of species.
- b) Get familiarised with Procedure to Survey and study the diversity of Odonata through various resources.
- c) Survey of Local area to select suitable spot to study and record various Odonates.
- d) Take a record photo shot and identify the species of with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
- e) Make list of various species and their abundance in the area and submit study report taking above mentioned points into the consideration.

11) Photographic collection of aquatic and terrestrial hemipterans.

- a) Make list of locally available hemipterans with the help of available resources.
- b) Familiarise with the life cycle and season of abundance hemipterans in the region.
- c) Take a record photo shot and identify the species of with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
- d) Submit recorded data and photographs accompanied with proper identification.

12) Photographic collection of colourful beetles and bugs from the local region.

- a) Make list of locally available Coleopterans with the help of available resources.
- b) Familiarise with the life cycle and season of abundance of coleopterans in the region.
- c) Take a record photo shot and identify the species of with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
- d) Submit recorded data and photographs accompanied with proper identification.

13) Types of honey bees and their culture.

- a) Procurement of resources such as reference books and data on honey bees and their culture.
- b) Visiting nearby apiculture plant Centre to fetch data about honey bees.
- c) Listing various species of honey bees and their attributes in regard to honey production quality and quantity.
- d) Preparing data to represent the survey and status of apiculture in your local area.
- e) Submission of study report with proper inference and suggestion if available.

Practical : Life and diversity of Animals (Non-chordata)

Practical : Two practical per week and each of 03 periods duration> The examination shall be of 04 hours duration and of 50 marks

I-Life and diversity of Animals (Non-chordata)
COs:

Upon completion of this course successfully, students would be able to perform/demonstrate

1. Observation, classification upto classes and sketching of the following animals (Specimens and models)
 - Phylum : Protozoa: Plasmodium trophozoite, Euglena, Entamoeba histolytica
 - Phylum : Porifera : Sycon, bath sponge, Euplectela
 - Phylum : Coelenterata : Obelia, Aurelia, Tubipora,
 - Phylum : Helmenthis : Taenia, Ascaris (male and female)
 - Phylum Annelida : Neris, Earthworm, Leech,
 - Phylum : Arthropoda : Prawn, Aranea, scolopendra, julus, moth, mosquito
 - Phylum : Mollusca : Chiton, Pila, Dentalium, Unio, Octopus
 - Phylum : Echinodermata : Antodon, holothuria, seastar, Brittle star
 - Phylum : Hemichordata : Balonaglossus
2. **Study of permanent slides**
L.S. of Sycon, nematocyst, Ascaris egg, T.S Ascaris through Testis and ovaries, T.S. Leech through Crop, Compound eye of Insect, Radula of Pila, Gill lamella, Osphradium of Pila, Scolex and gravid proglottid of Taenia
3. **Anatomical Study through computer aided techniques, Video clipping, models, photographs and other available resources**
 - a. Leech/Earthworm: Alimentary canal, reproductive system, Nervous system,
 - b. Grasshopper/ Cockroach; Digestive system, Nervous system, Reproductive system,
 - c. Culture of Hydra and Volvox (to be given to all students)
4. **Mounting**
 - a. Mosquito (culex and Anopheles) : Wings ,legs, mouthparts
 - b. House fly; Mouth pars, legs, wings
 - c. Paramecium and volvox

Distribution of Marks during Practical Examination: Time : 4 hrs.

i) Identification and comments on spots (1-8) 4 specimens, 4 slides	12 Marks
ii) Labelling of Anatomical diagrams provided (Two)	10 Marks
iii) Permanent stained micro preparation	08 Marks
iv) Study tour diary -	04 Marks
v) Permanent stained micro preparation Submitted by examinee	04 Marks
vi) Certified class record -	05 Marks
vii) Check list of 20 locally available invertebrate fauna.....	02 Marks
viii) Viva- voce	05 Marks
Total: -	50 Marks

Note:

- 1) One or two short excursion/study tours are compulsory for observation of animals in their natural habitat. 2) Candidates shall be required to produce at the practical examination the following.
 - Practical record book duly signed by the teacher in charge and Certified by the Head of the department as bona fide work of the Candidate.
 - Five permanent stained micro preparations.
 - Study tour report and field diary duly signed by the teacher.

Reference Books Recommended (All latest editions):

- 1) Hickman, C.P. Jr.F.M. Hickman and L.S.Roberts, Integrated principles of Zoology Mosby College publication St.Louis.
- 2) Ayyar, E.K. and T.N.Ananthakrishnan, Manual of Zoology Vol.I (Invertebrata), Part-I & II S. Viswanathan (Printers and Publishes) Pvt. Ltd. Madras.
- 3) Jordan, E.L. and P.S.Verma Invertebrate Zoology, S.Chand and Co., Ltd. Ram Nagar, New Delhi.
- 4) Parker and Haswell, Text book of Zoology, Vol. I (Invertebrata), A.Z.T.B.S. Publishers and Distributors, New Delhi –110051.
- 5) Waterman, Allyn J. et.al., Chordate structure and Function, Mac Millan and Co Newyork.
- 6) S.N.Prasad : Text Book of Invertebrate Zoology.
- 7) Vishwanathan : Invertebrate Zoology.
- 8) Majpuria : Invertebrate Zoology
- 9) Dhami and Dhami : Non-chordate Zoology.
- 10) Baini Prasad: Indian Zoological memoir. Pila.
- 11) R.L.Kotpal : Modern Text Book of Invertebrate Zoology.
- 12) Malviya M.K. Invertebrate Zoology, by Rajdhool publications.
- 13) S.S.Lal, Practical Zoology, Invertebrate.
- 14) Bhamrah H.S.and Kavita Juneja A text book of Invertebrate Zoology, Anmol Publication Pvt. Ltd., New Delhi.
- 15) Verma and Agarwal Practical Zoology, Invertebrate
- 16) - Barnes R.D. Invertebrate Zoology -(W.B. Saunders Co.)
- 17) P.G.Puranik and Thakur, Invertebrate Zoology.

Sant Gadge Baba Amravati University Amravati

Syllabus Prescribed for 2022-23 UG Programme

Programme : B.Sc-I : Zoology

There shall be the following paper and practical for **B.Sc. Part-I and Semester II** examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25 practical sessions during the complete semester). There shall be one compulsory theory paper of 3 hours duration, as stated below and a practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

Name of the programme: **B.Sc. I**

Class : **Part II S**

Semester : **II**, DSC-2-02S

Subject Zoology

Name of the course (Paper): **Life and diversity of Animals (Chordata) and concept of**

Evolution

Course Outcomes Code : COs-02

Max Marks : 80

About the course

The course is a walk for the Bachelor's entrant through the amazing diversity of living organism from simple to complex. The course makes a details comparison of the systematic study of different taxa of Non-chordate. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and an anatomy which led to their grouping into taxa and clades.

COs:

Upon completion of this course successfully, students would be able to

1. know what the chordates are.
2. Learn about the different phylum of chordates.
3. confidently explain the general characters and classification of Protochordates upto class Mammalia.
4. understand the level of organization in chordate.
5. explain the origin and evolutionary relationship in different subphylums of chordates.
6. describe specific features of Protochordates upto class Mammalia.
7. recognize and differentiate life functions of Protochordates upto class Mammalia.
8. understand Migration in fishes and birds , parental care in Amphibians and Poisonous and non-poisonous snakes.
9. explain the adaptations in Birds and Mammals.

Unit – I:

Phylum Chordata

12 L

1. Origin of Chordata
2. Protochordates: Type study: *Amphioxus*, Habits and habitat, External characters, Digestive system and feeding, Excretory organs, gonads, Affinities of *Amphioxus*. Affinities of Agnatha.
3. Series: Pisces: Type study: *Scoliodon sorrakawah* (Dog fish) Habits and habitat, External characters, Respiratory system, respiratory organ and mechanism of respiration, circulatory system, structure and working of heart, Lateral line receptors. Migration in fishes- types causes and significance.

Unit: II

12 L

1. **Class Amphibia:** Type study: *Rana tigrina*: Habits and habitat, Respiratory organ, Circulatory system, structure of heart, major arteries and vein, Urinogenital system. Parental care in Amphibia.
2. **Class Reptilia:** Type study: *Calotes versicolor*- Habits and habitat, Circulatory system, Structure of heart, major arteries and veins. Types of Snake venom and anti-venom.

Unit: III

12L

1. **Class Aves:** Type study: Pigeon -*Columba livia*, Habits and habitat, external characters, Respiratory system, Urinogenital system, flight adaptation, Migration in birds.
2. Class: Mammalia: Primitive mammals: Salient features of Prototheria and Metatheria, Aquatic mammals, Flying mammals. Adaptive radiation in Mammals.

Unit: IV

12L

1. Evolution meaning and scope
2. Indirect evidences of evolution: Evidences of organic evolution-morphological and anatomical, physiological and biochemical, embryological.
3. Direct evidences of evolution: Paleontological evidences: Fossil and fossilization: petrified fossils dead and preserve bodies and moulds, trails and foot prints, condition for fossilization. Radioactive carbon dating of fossils. Living fossil. Importance of fossil record. Evidences from connecting links – *Peripatus* and *Archaeopteryx*.

Unit: V

12 L

1. Evolutionary Processes: Natural selection: Darwinism and Lamarckism
2. Speciation- definition of speciation-Allopatric and Sympatric speciation.
3. Modern concept of organic evolution -Neo-Darwinism. Population Genetic: Hardy - Weinberg equilibrium, Gens pool, Gene frequency, Genetic drift, Convergent, Divergent and parallel evolution, Coevolution.

Unit VI:

12L

1. Evolution of Man-brief accounts of Parapithecus, Dryopithecus, Parapithecus, Australopithecus, Homoerectus, Neanderthal man, Cro-magnon man and modern man. Evolution of heart and aortic arches
2. Animal adaptation: Desert, Aquatic and Terrestrial.

Unit VII:

Skill Enhancement Module—(SEM)

20 M

Upon completion of this course successfully, students would be able to perform/demonstrate

1. Study on edible fishes from the local region.

- Select local spots.
- Find various water reservoirs from selected areas.
- Choke out a plan to visit.
- Observed edible fishes and their photographic records.
- Prepare the data in a scientific way and submit.

2. Case study of diversity in frogs from surrounding areas.

- Select a different location from the surrounding area.
- Search for varieties of frog by observing in the particular area.
- Take photographic records and classify accordingly.
- Comparative study of their occurrence in different locations.
- Prapare a scientific data and submit.

3. Survey of Photographic evidence of parental care in frogs in monsoon.

- Study is carried out during monsoon season only.
- Focus selective location where the possibility of frog nesting occurs.
- Multiple visits during June to September to get expected results.
- Prepare data with photographic evidence and submit.

4. Survey the diversity of snakes in the surrounding area.

- * Visit a locally working snake rescue team.
- * Involved in their rescue operation in the surrounding area.
- * After a multiple visit, prepare data with snake photographs and classify accordingly.
- * Prepare Survey report and submit it.

5. Survey of Migratory birds in the forest /Grassland/Field.

- * Find out a list of migratory birds and visit the selected area from the books and other bird organizations
- * Decide multiple visits to the selected area.
- * Prepare a list of observation and Photographic records.
- * Compare this list with actual records which are mentioned in books and other reservoirs.
- * Submit a final report of the bird survey.

6. Case Study of migratory wetland birds from local reservoirs.

- * Download a list or read a list of migratory wetland birds from IUCN red data list or renowned books.
- * Select reservoir for case study from the surrounding area.
- * Visit during migration period i.e. September to May.
- * Try to take a photograph of migratory bird species from the different reservoirs.
- * Prepare the data with a basic classification and a few characters with photographs and submit.

7. Prepare a model on the evolution of man.

- * Find out the latest information from the internet and recent books on evolution of man.
- * Collect a photographic record and their history and related information.
- * Prepare a model with photographic records and basic information like evidential proof, period of occurrence, characters etc.
- * Submit this model.

REFERENCE BOOKS:

1. Integrated Principles of Zoology, 7th Edition, Hickman, C.P. Jr., F.M. Hickman and L.S. Roberts, 1984. Times Mirror/Mosby College Publication. St. Louis. 1065 pp.
2. A life of Vertebrate – K.Z. Young, ELBS Oxford University Press.
3. A Text Book of Chordates – H.S. Bharmah and Kavita Juneja.
4. Modern Text Book of Zoology Vertebrate – R.L. Kotpal, Rastogi Publication Meerut.
5. A Text Book of Chordates – A. Thangamani, S. Prasannakumar, L.M. Narayanan and
6. Arunmugam Saras Publication, Nagercoil.
7. A Text Book of Chordate Zoology – R.C. Dalela – Jaiprakashnath Publication Meerut.
8. Chordate Zoology – E.L. Jordan and P.S. Verma, S. Chand and Company New Delhi.
9. A Text book of Practical Zoology Vertebrate – S.S. Lal, Rastogi. Publication, Meerut.
10. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.
11. Chordate Zoology and Elements of Animal Physiology, Jordan, E.K. and P.S. Verma, 1995. 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
12. Zoology of Chordates, Nigam, H.C., 1983. Vishal Publications, Jalandhar - 144 008, 942.
13. The Phylum Chordata, Newman, H.H., 1981. Satish Book Enterprise, Agra - 282 003, 477 pp.
14. Text Book of Zoology, Vol. II (Chordata), Parker and Haswell, 1964. A.Z.T.B.S. Publishers and Distributors, New Delhi – 110 051, 952 pp
15. Chordate Structure and Function, Waterman, Allyn J. et al., 1971. Mac Millan & Co., New York, 587 pp.
16. Simpson, G.C. 1967 - The meaning of Evolution. Revised Edition – New Haven, Yale University Press.
17. Colbert, E.H. 1969 - Evolution of Vertebrates, Wiley, New York.
18. Mayr, Ernst, 1973 - Animal Species and Evolution. The Belknap Press of Harvard University, Cambridge.
19. Dobzansky, T. 1976 - Genetics and the Origin of Species. Oxford and TBH Publishing Co. New Delhi.
20. Savage, J.M. 1976 - Evolution. Amerind Publishing Co. Pvt. Ltd. New Delhi.
21. Elic. Minkoff, 1983 - Evolutionary Biology, Addison Wesley.
22. Life, Origin, Evolution and Adaption (2002) – Sanjib Chattopadhyay. Books and Allied (p) Ltd.
23. P.S. Verma & V.K. Agrawal. (2008) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology – S. Chand Publications.

24. Dhabade. D.S. I. A. Raja. R.A>Gulhane. A.P.Charjan. A.K.Patki., And P.S.Patil.,A Text Book of Evolution: Sanket Publicatin. Washim
 25. Zoology for Degree Students, Prof.Dr.V.K.Agrawal.

Practical:-

Two practical per week of 3 periods duration. Examination shall be of 5 Hrs duration and of 50 marks.

COs:

Upon completion of this course successfully, students would be able to demonstrate/perform/accomplish the following

1. General characters and classification of Phylum

Chordata:

2. General characters and Classification up to orders of the following chordates or as per the availability in the laboratory from the major orders, (Specimens or Models):

Protochordata: Herdmania, Dolium Salpa, Amphioxus.

Agnatha: Petromyzon, Myxine.

Pisces: Scoliodon, Torpedo, Acipenser, Exocoetus.
Hippocampus

Amphibia: Ichthyophis, Salamander, Bufo, Hyla.

Reptilia: Varanus, Phrynosoma, Chameleon, Cobra, krait,
Russell's viper, Typhlops, Hydrophis

Aves: Duck, Woodpecker, Kingfisher, Parrot.

Mammalia: Mongoose, Squirrel. Manis. Bat., monkey,

B) Dissections:

1. Dissection - afferent and efferent branchial vessels, cranial nerves, internal ear of scoliodon.
2. Dissection - Digestive system, Arterial system, venous system, reproductive system of rat.
3. Permanent micro-preparations .a. Fish scales. b. Ampullae of Lorenzini. c. Eyeball muscles.
4. Observations of air bladder in air breathing fishes.

C) Osteology. Rabbit, Varanus (excluding loose bones of skull).

D) Evolution:

1. Study of fossils, including living fossils.
2. Study of Evidences of evolution.
- i) Analogous and Homologous organs.
4. Study of Mesozoic Reptiles (By Models/Charts).
5. Mimicry, coloration in animals.
6. Beak and Leg modifications with reference to: Parrot, Woodpecker, Kingfisher, Heron, Duck, Sparrow/Pigeon Hawk/Kite, Owl.

E) Histological Slides :- Amphioxus, Frog, Rat

Slides :

T.S, Oral hood, Pharynx, Tail

T.S. lung, Stomach, Kidney, T.S. Intestine,

T.S. Liver, Pancreas, Ovary, Testes, Pituitary,

Thyroid, Adrenal

**DISTRIBUTION OF MARKS FOR
PRACTICAL EXAMINATION.**

1. Dissection: -	10
2. Permanent stained micro preparation.	05
3. Spotting. (Specimens, Slides, bones, fossil)	10
4. Practical on evolution -	10
5. Class record	05
6. Viva - Voce	05
7. Submission of study tour report.	05

Total Marks: 50

Course- Zoology
General Interest Course (GIC)

Title: Snake Identification their Rescue & Snake Bite Management

Course Duration :

15 hours

Email- profpraveenjoshi@gmail.com

Credit : 01

Course Information:

The importance of snakes in nature is extraordinary. They play an important role in the food chain. The snakes are found in all habitats like villages, towns, farms and forests but in villages and cities people are often bitten by snakes and die prematurely but these are due to poisonous snakes but among the diversity very few snakes are poisonous but people unaware of the facts. Most of the time non-venomous snakes bite and they do not cause death but lack of information creates fear and kills snakes. The snake maintains the balance of the environment by controlling the population of many species such as rodents, mice, small mammals, birds and reptiles. In this course students will be given complete information about the species of snakes commonly found in Vidarbha, their habitat, predators, behaviors, snake bites and its causes and remedies as well as beliefs about snakes and superstitions and their importance in nature. Students can effectively spread awareness about snakes in the society through this medium.

Course Outcome:

Every student participating in the course will get to know about the different species of snakes in Vidarbha. The student can easily identify venomous and non-venomous snakes. It will be possible to differentiate between venomous and non-venomous snake bites. Participate in a rescue operation with volunteers from a snake rescue organization. Understand how to catch them. Students confidently told about the habitat of snakes, their role in nature and why it is important to save snakes. Visiting hospitals for people who have been bitten by snakes will help them to understand the difference between the bites of different venomous snakes. Awareness can be created by taking active part in future campaigns on the importance of snakes for the environment.

Facility provided by the Institution:

First of all, cooperate with the local organization working on snakes. Make available books on snakes to the students through the college library. Provide information about snakes with the help of photos and videos with the help of projector. With the help of children working in the organization, go to different habitats and give information about catching snakes. Visit a snakebite victim at a local government hospital. Create awareness about snake bites in the future, how to prevent snake bite accidents.

Course Syllabus

Unit 1

10 L

- General information of world wide diversity of snakes.
- Diversity of snakes in India, Maharashtra and Vidarbha region.
- Identification of poisonous and non-poisonous snakes in Vidarbha.
- Participating in snake rescue operation and developing skill handling and capturing of snakes under the guidance of authorized snake catchers.
- Arrange field visits to know about different habitats of snakes.

Unit 2

10 L

- Role of snakes in the environment.
- Snakes are important creature in the food chain.
- Methods to avoid the snake bite.
- Identification of different poisonous snake bites and non-poisonous snake bite.
- Primary steps after snake bite.
- Volunteers in snake bite operation.

- Participating while arranging rallies, lectures and seminars in public places in creating an awareness of saving snakes and saving nature.

Evaluation Methods:

1. Submit Project based on Local diversity of snakes. ----- 10 marks
2. Deliver a seminar on any topic based on syllabus. ----- 10 marks
3. Participation certificate in a snake rescue team by the local snake organization.—5 Marks
4. Member of awareness program which will be run by the organization for saving snakes.- 5 Marks

Bibliography:-

1. Venomous Bites from Non Venomous snakes:A Critical Analysis of Risk By,D.A.Warrel,Daniel E.Keyler Julian White and Scott
2. Guideline for the management of snakes bites World Health Organization Regional Office South East Asia.
3. Snakes of the world-A catalogue of living and extinct species by Van Wallach,Kenneth L. Williams and Jeff Boundy-Google Book.Dec-1995.
4. Snakes of India-Romulus Whitakar and Ashok Captain
5. Common Indian Snakes- Romulus Whitakar
6. Snakes of Maharashtra- Neelamkumar Khaire
7. Reptiles and Amphibians of India: J. C. Daniel
8. Uncover a Cobra: Van Wallach.
9. Reptiles By: J.Z.Young
10. Vertebrates Zoology: P. S. Verma, S. Chand Pub. N. Delhi
11. Vertebrates Zoology: R. L. Kotpal, Rastogi Pub. N. Delhi

Course- Zoology

General Interest Course (GIC)

Title: Basic Course in Ornithology

Course Duration : 15 hours

Credit : 01

Course Outcome:

The student who has taken admission in this course will get basic knowledge of bird species from all over the world as well as complete information about bird species found in Maharashtra and Vidarbha. Course students will get an in-depth knowledge of various bird species in nature, their functions, their major habitats, bird-specific habitat. Students may have the opportunity to work on various research projects run by international or national bird organizations. Students can set up their own bird tour company, organize small bird tours at famous bird sanctuaries in India, pursue their hobbies and earn money through the tour. Students can put up an exhibition of selected photographs of the birds they photograph while going birding each day. This will make people aware of the local bird diversity and at the same time help encourage other students who are interested in the field. Students can also earn money by selling selected photos displayed in the exhibition.

Course Information:

This course is mainly based on Birds which is an indicator of a healthy environment, an important component of the food chain, attracting everyone with its appearance and sound. This is made especially for people who love birds and nature. The main objective of this course is to give the students an in-depth knowledge of the bird world of Vidarbha as well as to introduce the bird diversity of the world and the bird world of Maharashtra. Students need to be informed that birds play an important role in the environment. It is important to show how the extinction of bird species will adversely affect nature. It is important to explain the potential threats to habitat and the steps that need to be taken to address the rapidly declining number of bird species and the extinction of many species. Students will be informed about the number of migratory birds that come to Vidarbha from all over the world. Students will be given full information about the category they fall under as per IUCN. The benefits of bird watching for the environment, physical and mental health will be explained. It will be informed that many job opportunities are available due to this course. Students will also learn about the close relationship between birds and tourism so that we can start our own business in this field.

Facility provided by the Institution:

The Institute will make available the required books for this course in the Library. Provide an up-to-date classroom with projectors, computer systems and important study materials. In addition to regular teachers, guest lectures will be provided by expert teachers of related subjects. Programs such as workshops, seminars, group discussion field visits of experienced people who have been working in this field for many years will always be conducted. A study tour of the relevant subject will be organized by the college during the course. Students who have taken admission in the course will be given an opportunity to participate in their various activities by collaborating with an organization working in the field of birds.

Course Syllabus**Unit 1**

10 L

- To introduce Bird diversity of the Indian subcontinent.
- Basic information about Bird Diversity of India, Maharashtra and Vidarbha region.
- Species based categorization (Prey birds, Passerine and waders).
- Diversity of residential birds of Vidarbha.
- Migratory birds visited the Vidarbha region.
- Rare birds are recorded as per IUCN in the Vidarbha region.

Unit 2

10 L

- Important bird watching tips and materials needed for bird watching.
- Benefits of Bird watching.
- Role of birds in the environment.
- Identification and census methods of birds.
- Reason for decline in population of birds in Vidarbha region.
- Steps involved in their habitat management and conservation.
- Birds and Tourism.

Evaluation Methods:

1. Visit local birding spots and submit a diversity survey report. ----- 10 M
2. Deliver a seminar on any one of the topics from the syllabus. ----- 05 M
3. An exhibition of photographs of various species of birds taken during the Bird Survey should be displayed in the college. ----- 10 M
4. Volunteer for a few days with an organization working in the various issues like field of bird species diversity, destroy habitat and needs of conservation and submit its certificate.—05 M

Bibliography:-

- Abdulali, H. (1972), Checklist of Birds of Maharashtra. Bombay Natural History society, Mumbai.
- Ali, S. The book of Indian birds. (13th Edition). Bombay Natural History Society. 2012; 239 Oxford University Press.
- Bibby C.J., N.D. Burgess & D.A. Hill (1992). Bird Census Techniques. Academic Press, London, 67–84 pp.
- Daniels, R.J.R. (1997). A Field Guide to the Birds of South-Western India. New Delhi: Oxford University Press, 217pp.
- Grimmett, R., C. Inskipp & T. Inskipp, Birds of the Indian Subcontinent. Oxford University Press, New Delhi. 2012; 528pp.
- IUCN - ENVIS Center, IUCN Red List of Threatened Species. 2018; IUCN category. Kazmierczak, K. (2000). A Field Guide to the Birds of the Indian Subcontinent. A & C Black Publishers Ltd., Pica press, 352pp.
- Kazmierczak, K. A Field Guide to the Birds of the Indian Subcontinent. A & C Black Publishers Ltd., Pica press. 2012; 352pp.
- Kumar, A., J.P. Sati, P.C. Tak & J.R.B. Alfred . Handbook on Indian Wetland Birds and their Conservation. Zoological Survey of India. 2005; 218pp.
- Grewal B., Harvey B. and Pfister O. Birds of India. Periplus Editions (HK) Ltd. 2011; 512 pp
- Steward R.E. Jr., (1999). Technical aspects of wetlands: Wetlands as bird habitat. United States Geologic Water Supply Paper, pp. 24-25

Course- Zoology
General Interest Course (GIC)

TITLE - ENVIRONMENTAL ISSUES AND ITS AWARENESS

Course Duration – 15 Hours

Total Credits – 1

Course Information:

This credit course benefits students to perceive how their decisions and actions affect the environment. It augments their knowledge and skills necessary to address complex environmental issues. Also, it helps to chalk out strategies to keep our environment healthy and sustainable for the future.

This course empowers students to make connections and apply their learning in the real world. It helps pupils to see the interconnectedness of social, ecological, economic, cultural, and political issues. This course encourages students to investigate multiple facets of environmental issues to comprehend the situation as a whole. It promotes tolerance of different points of view and different cultures.

By exposing students to nature and allowing them to learn outside, this course nurtures sensitivity, appreciation, and respect for the environment.

Course outcomes:

- Students will understand current environmental scenario with clearer concepts in mind.
- Students will have Ability to demonstrate understanding of the environmental processes and will possess knowledge of the changing climate.
- Students will have Ability to comprehend to structure and functions of ecosystem.

- Students will know how to identify and quantify the magnitude and intensity of Environmental pollution problems.
- Student will have Ability to demonstrate understanding Environmental Laws and policies in India.
- Student will appreciate the ecosystem responses to climate change and how environmental crisis will greatly impact both current and future generations of humans and all other species.

Facility provided by the Institution:

- Institute will provide necessary equipment's for practical sessions.
- Institute will arrange guest lectures of eminent personnel in the field, so as to give better depth and understanding of the subject.
- Institute will arrange field visits to various Industries to show and assess their commitment to save environment.
- Institute will provide various e-learning resources for better understanding of the subject.
- Library facility and reference books will be made available to the students enrolling for the course.

Course Syllabus

UNIT I -Introduction to environmental studies.

10 L

- Definition, scope and importance.
- Need for public awareness.
- Environmental ethics: Issues and possible solutions.
- From Unsustainable to Sustainable development
- Water conservation, rain water harvesting, watershed management
- Climate change, global warming, acid rain, ozone layer depletion.

UNIT II - Natural resources

10 L

- Natural resources and associated problems. Types of resources.
- Forest resources: Use and over exploitation, deforestation.
- Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
- Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act. Forest Conservation Act.

Evaluation Methods

- Presentation on any one suitable topic from syllabus at the end of course. 10 M
- Submission of Dissertation on topic which includes at least one Case Study. 10 M
- Submission of Excursion tour Report / Submission of Report on Industrial Visit. 05 M
- Certificate from any Environment Cause related NGO / GO / NSS Unit (From College) for Spending Not less than 10 Hrs for any Environmental Cause. 05 M

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